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The Biological Manifestation of Health, Culture, and Disease in Turn of the Twentieth Century San Francisco

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The Biological Manifestation of Health, Culture, and Disease in Turn of the Twentieth Century San Francisco

By

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This thesis has been examined and approved by the following members of the student's committee.

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TABLE OF CONTENTS

ABSTRACT

The Biological Manifestation of Health, Culture, and Disease in Turn of the Twentieth Century San Francisco

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Between 1880 and 1920, a period known as the Great Migration, the city of San Francisco became one of the most diverse areas in the United States due to the steady arrival of immigrants. These groups of immigrants primarily consisted of individuals from China, Japan, Ireland, Italy, Eastern Europe, and Mexico. However, each of these groups faced various forms of xenophobia from American-born citizens when they tried to either earn a living or assimilate into American society. These immigrant groups were frequently impeded by who was, and who was not, considered to be "white" in the eyes of the dominant culture. In bioarchaeology, there is a known relationship between social conditions and health, which physically manifests in skeletal remains and can therefore be measured using osteological methods to study inequalities and health in the past. In this study, a random sample of 144 individuals of both male and female sex was analyzed from the University of Iowa Stanford Collection, which contains the remains of over 1,100 immigrants from the turn of the twentieth century San Francisco. The individuals were analyzed for the presence of the following skeletal indicators and pathological conditions: tuberculosis, cribra orbitalia, porotic hyperostosis, periostitis, osteomyelitis, antemortem tooth loss, and linear enamel hypoplasia. Each of these pathologies was used to compare immigrant health to that of individuals born in the United States and determine to what extent their health was impacted by social inequality. This study found that socioeconomic status, more so than sex or immigration status, played a pivotal role in the health of these individuals.

CHAPTER ONE: Introduction

In the United States, the period between 1880 and 1920 was marked by a steady influx of immigrants from various regions throughout Europe, Asia, and North America. This period, since named the Great Wave of Immigration, represented the convergence of new peoples, new technologies, and old diseases that resulted in tension between those who had immigrated to the United States previously, including their descendants, and those who were just arriving (Kraut 1994, 52; Markel 1998, 1020). This was especially true in the San Francisco region.

The city of San Francisco underwent tremendous growth throughout this period that would not have been possible without the contributions of various immigrant groups. These groups primarily consisted of immigrants from China, Japan, Ireland, Italy, Eastern Europe, and Mexico. However, each of these immigrant groups experienced various forms of xenophobia from Western European-descended American citizens when they tried to earn a living or assimilate into American society. Oftentimes, immigrant groups were impeded by who was, and who was not, considered to be white in the eyes of the dominant culture.

New immigrants were often viewed through misguided ideas on biological and cultural inferiority by American citizens of primarily white, Western European heritage, who considered themselves to be both more advanced and more evolved than the new waves of ethnically diverse immigrants. Typically, anthropologists and other social scientists have defined ethnicity as the "historical and cultural traits common to a group, such as a 'homeland,' a shared language, similar religious beliefs, and characteristic dietary and personal habits, as well as a shared heritage," (Marks and Worboys 1997, 2). The views of white, Western European-descended American citizens left little room for the economic and social advancement of many ethnic immigrant groups in turn of the twentieth century American society. American-born citizens often defined these immigrant groups as belonging to completely different, and inferior, racial groups.

While conducting investigations into the human experience over the past fifty years, anthropologists, sociologists, and other social scientists have repeatedly observed the relationship between social conditions and human health. Frequently, individuals with the lowest socioeconomic position within a society have the least access to resources and, subsequently, are the most likely to experience disease (Link and Phelan 1995, 81; Acevedo-Garcia et al. 2012, 2062; Bakhtiari 2018, 140). These individuals were often immigrants because the process of migrating often forced immigrants to abandon the resources they had acquired over their lifetimes in their country of origin. Of course, some new immigrants were able to climb the ladder of prosperity, but the vast majority were socially and politically excluded from participating in anything besides hard labor and low-wage jobs for at least a generation (Fairchild 2004, 529; Imperato and Imperato 2008, 227; Acevedo-Garcia et al. 2012, 2062; Bakhtiari 2018, 140). Left to the edges of society, immigrant groups frequently entered into the lowest socioeconomic levels in the United States. Consequently, the socioeconomic gap between the upper classes and the lower classes during the turn of the twentieth century strongly impacted these immigrants' ability to access resources, preserve a livelihood, and, ultimately, maintain their health.

As one of the most diverse regions in the United States due to large numbers of European, Asian, and Mexican immigrants, in addition to the American citizens and indigenous peoples who had already populated the area, San Francisco is the perfect case study to observe the relationship of structural violence and health on immigrant populations. This thesis focuses on and compares the health, as manifested in their skeletal remains, of immigrants and American citizens who called this city home at the end of their lives.

Within bioarchaeology, there is a consensus that both environmental conditions and social environment, in this case racism and low socioeconomic status, manifest themselves physically in skeletal remains. Since health is widely known to be dependent on both of these factors, bioarchaeologists measure health to assess inequalities in past populations through the analysis of skeletal pathologies and other markers of biological stress. In this study, a random sample of 144 individuals of both male and female sex was analyzed from the Stanford Collection, which contains the remains of over 1,100 immigrants from the late nineteenth and early twentieth century San Francisco. The individuals were macroscopically analyzed for the presence of health indicators embodied in the skeleton through the following pathological conditions: tuberculosis, cribra orbitalia, porotic hyperostosis, periostitis, osteomyelitis, linear enamel hypoplasia, and antemortem tooth loss. Each of these pathologies was used to assess the overall health of the immigrant population and to what extent it was determined by social inequality.

CHAPTER TWO: Background

Social Status and Health

Throughout the past fifty years, social scientists have repeatedly observed the relationship between social conditions and human health (Link and Phelan 1995, 81; Sabbah et al. 2009, 516; Hankin and Wright 2010, S10; Amoroso et al. 2014, 467; Zuckerman and Crandall 2019, 161). Typically, social conditions are defined as "factors that involve a person's relationship to other people, including everything from relationships with intimates to positions occupied within the social and economic structures of society," (Link and Phelan 1995, 81). As social scientists have been studying both the positions of individuals and groups in societies, they have increasingly noted that social position, more than any other factor, determines one's health status and overall susceptibility to disease.

Generally speaking, health, or the concept of being healthy, refers to the absence of disease or illness within an individual's mind and body or within a population as a whole. However, this definition can vary across cultures and individuals. For instance, an individual may possess a chronic disease that impairs their ability to function within their normal cultural parameters, but they might still be considered healthy within the confines of their specific disease.

The connection between social position and health is primarily shaped by access to resources. Overall, the ability to access resources allows people to "avoid risks or to minimize the consequences of disease," (Bakhtiari 2018, 139; also see Hankin and

Wright, 2010, s11). Access to resources, including nutritious food, sanitation, and health care, has a tremendously positive impact on individual well-being. Additionally, access to resources, such as “money, knowledge, power, prestige, and the kinds of interpersonal resources embodied in the concepts of social support and social networks,” allows individuals to avoid or minimize unpleasant portions of life (Link and Phelan 1995, 87). Therefore, individuals who have access to resources tend to have better health than those without. Individuals without access to resources, however, tend to be further impacted by “social disorder, concentrated poverty, social isolation, stressful life events, chronic strains, and traumas,” each of which has been proven to further negatively impact overall health (Hankin and Wright 2010, s11).

Throughout the late nineteenth and early twentieth centuries, the people in America who frequently had the least access to resources were recent immigrants – especially those who looked different or had different cultural backgrounds from the majority population at this time. Immigrants are individuals who either choose to or are forced to leave one country or region for another. Immigrants have many reasons for choosing to leave their homeland, including (but not limited to) fear for their safety due to war, famine, religious/political persecution, or hope for improving their socioeconomic status for themselves and their offspring.

During this period, immigrants often bore the worst of American-born society’s fears of disease and economic instability, which limited their ability to blend into American life (Markel 1998, 1023; Imperato and Imperato 2008, 228; Bakhtiari 2018, 1400). Immigrants were rarely able to bring many resources with them from their country of origin, and once they arrived in the United States, they were commonly faced with ethnic segregation and linguistic barriers that limited their ability to acquire necessary resources. Again, the lack of accessible resources has been negatively linked to health. Therefore, immigrants to the United States during this period were often "at an increased risk for chronic disease, communicable diseases, injury, social isolation, malnutrition, and stress," and subsequently "lower life expectancy, higher mortality rates, and higher rates of infant and perinatal mortality," than their white American-born counterparts (Link and Phelan 1995, 81; also see Hankin and Wright 2010, s11).

Defining Race in the United States

Within the modern discipline of anthropology, it is accepted that culture directly impacts the lived experiences of individuals. Although all humans are recognized as being biologically equal in ability, "their varying degrees of accomplishment [are] due solely to different measures of accord with the social environment with which they are in touch," (Kroeber 1917, 204). As such, the anthropological discipline does not identify innate differences between the subtle biological variations within the human species. Instead, it is the confluence of both environmental and cultural factors that create differences in ability between the perceived racial human subgroups. In other words, the social creation of racial groups results in a physical reality, rather than the other way around (Baker 1998, 4; Goodman 2006; Dove 2018, 136; Nieves Delgado 2018, 468). One major concern of modern anthropological research is the relationship between socioeconomic status, race or ethnic background, and health.

American society was, and still is, dependent on a social hierarchy that generally has privileged, or provided a greater range of opportunity to, white individuals over those with darker skin or non-Western European origins. This thesis focuses on the way that this social hierarchy has impacted the health of both immigrants and Western European-descended American citizens in the late nineteenth and early twentieth centuries.

As previously stated, an individual's position within the social hierarchy shapes access to resources. Oftentimes, the manifested social hierarchy has allowed individuals who were white and descended from Western European immigrants to have the greatest access to resources (Cherny et al. 2011, xvi; Bakhtiari 2018, 140-141). This has allowed many white Americans, both at the turn of the twentieth century and today, to feel that they are both biologically and culturally superior to other ethnic groups; these views have impacted the United States' political atmosphere. These ideas were widely reinforced by the eugenics movement of the early twentieth century.

The eugenics movement gained traction in the United States at the end of the nineteenth century due to increasingly prevalent social issues. It was predominantly concerned with scientifically identifying the differences between racially defined groups of people and, subsequently, keeping these groups separated to achieve racial purity – especially for the self-identified "superior" white, Western European race (Marks and Worboys 1997, 5; Adams et al. 2005, 234; Bakhtiari 2018, 140). Francis Galton, a relative of Charles Darwin, originally coined the term "eugenics" in 1883 and his work focused on applying animal husbandry techniques to improving the human race by weaning out undesirable traits (Fischer 2012, 1096). Even the anthropological discipline during this time concentrated on finding differences in both cultural construction and skeletal anatomy to prove the racial hierarchy existed (Blakey 2001, 389; Banton 2012, 1111; Spencer 2017, 23), although their efforts have long since been disproved and have no merit in the modern scientific community. Throughout the twentieth century, though, the eugenics movement drove fears of racial impurity and the looming dominance of ethnic minorities from unchecked immigration, which ultimately ignited widespread fear and distrust of immigrant groups that persisted throughout the nation (Imperato and Imperato 2008, 227; Allen 2013, 38). The active eugenics movement was able to take root in American society in the early twentieth century largely due to the pre-established practice of formalized African or black enslavement that the United States that was built through the 1860s and that continued in its aftermath, including "the persistence of white prejudice and discrimination resulting from slavery," which has since become "the central organizing principle of race/ethnic relations in the United States [that] has revolved around the axis of the black-white color line," (Lee and Bean 2007, 562).

The black-white color line references the vast history of racial relations in the United States; it is the hypothetical line that has prevented people with darker skin from achieving the same social prestige as white, Western European-descended Americans (Banton 2012, 1110; Lew-Williams 2017, 633). After the Civil War, the black-white color line was legally enforced through Jim Crow laws in the South and, when those laws were eventually disbanded, through other forms of discrimination such as gerrymandering, the prison system, and other systemic forms of violence. In this way, the eugenics movement continued passively throughout the twentieth and twenty-first centuries. The black-white color line dictates that individuals with darker or black skin were automatically considered black regardless of their ancestry or ethnic origins, while people who had white skin were considered white – as long as they did not have any black or African heritage (Lee and Bean 2007, 564; Chase-Ribound 2009, 827; Khanna 2010, 98; Bakhtiari 2018, 140). This concept has formed the basis for America's black-white color line. However, as various other ethnic groups began to immigrate to the United States, including individuals from Ireland, Italy, Eastern Europe, Asia, and Central America, the black-white color line's enforcement became much more nuanced.

In the nineteenth century, Irish, Italians, Eastern Europeans, Asians, and Central American immigrants were all considered to be non-white and thus fell towards the middle of the social hierarchical color line (Gardner 1999, 81; Lee and Bean 2007, 566; Paddison 2009, 505; Bakhtiari 2018, 140). They were not socially grouped with African Americans, but they were not included with white, Western European-descended Americans either. These immigrants formed a middle tier in the United States racially based social hierarchy. Over time, however, several of these groups were able to reimage themselves in the eyes of white American-born citizens as white.

For instance, when they first began immigrating to the United States in large numbers due to the potato famine and its aftermath, the Irish were initially referred to as "white Negroes" by Western European-descended Americans but, over time, they were able to attain the perception of "'whiteness' by shifting their political alliances, achieving economic mobility and adopting deliberate and extreme measures to distance themselves from African Americans" and other distinctly non-white groups, such as the Chinese (Lee and Bean 2007, 566; also see Paddison 2009, 505; Gerber 2014, 149). Likewise, over time, Italians and Eastern European immigrants, who were described as coming from "the cesspools of Europe," were also able to eventually cross the black-white color line, thus improving their socioeconomic position in the United States (Daniels 1997, 10). This was an important achievement for these immigrant groups, because in such an ideological environment, "many of the social conditions that characterized life for these groups – low socioeconomic status, occupational and residential segregation, and experiences of discrimination – are considered key social determinants of poor health and early mortality for minority groups," (Bakhtiari 2018, 140). By switching their position within the black-white color line in the eyes of American-born citizens, these European immigrants were able to improve their socioeconomic status and, consequently, their health.

Although eventually, most early twentieth century European immigrants were able to change their image and be perceived as "white" by Western European-descended American citizens, and therefore be accepted into the wider dominant culture, immigrants from Central and South America, Mexico, and Asia have not been able to escape the black-white color line – even today (Bakhtiari 2018, 141).

This does not mean they have not tried. In 1922, Japanese immigrant Takao Ozawa brought his case to the Supreme Court after his application for United States citizenship was denied, despite having lived in the country for many years. Previous legislature had proclaimed that any free white person or African descendant could apply for legal citizenship; however, Ozawa was denied. The Supreme Court ultimately ruled that only those of Caucasian descent were legally white, and because Japanese immigrants were not descended from the Caucasian race, they were not white but rather members of an "unassimilable race," (Takao Ozawa v. United States, 1922; Van Nuys 1994, 13; Lee and Bean 2007, 565).

Likewise, because the ideology behind the color line has dominated much of the political, social, and economic structure of the United States both throughout history and today, African Americans, those of African ancestry, and many indigenous populations have not been able to overcome the subjugations of the color line. Their oppression has continued through discrimination and discrepancies in health and quality of life compared to their white counterparts (Lee and Bean 2007, 567). This concept will be explored further in the following section.

Structural Violence Against Immigrants in the United States

Racist ideology was rampant in the turn of the twentieth century America, which largely stemmed from a history of slavery and encouragement from the eugenics movement. Between 1890 and 1920, the United States government responded to outcries from white, Western European-descended American citizens to control the increasing influx of immigrants by passing restrictive legislation that limited who could and could not enter the county, and, as in the case of Takao Ozawa, who had the right to become an American citizen. The eugenics movement, and its dedication to scientifically prove racial differences between populations, provided the general public with the language to support and legislatively implement racist ideologies (Bakhtiari 2018, 140). Although this period was known as the Progressive Era of social reform, it was anything but "progressive" for those who were not at the top of the American social hierarchy.

Anti-Immigrant Legislation

As early as 1882, Congress began using its authority to control the flow of immigration into the United States – often due to objections raised by Western European-descended Americans. For instance, throughout the West Coast, large numbers of Chinese immigrants had been arriving since the California Gold Rush of the 1840s to mine for gold and, once this had ceased to be a viable source of income, to construct the newly expanding system of railroads (Epstein 1990, 51; Craddock 1995, 959). Eventually, many Chinese immigrants began to migrate into larger urban centers in search of work once the railroad systems were largely completed. When an economic recession rocked the region in 1875, causing unemployment rates and poverty to dramatically increase, Chinese immigrants were especially vilified by white, Western European-descended Americans because of the increasing competition for limited resources (Yamato 1994, 32; Craddock 1995, 960; Fairchild 2004, 529; Imperato and Imperato 2008, 228; Cherny et al. 2011, 109). Competition over scarce resources occurs between populations confined to a single area and is a frequently observed response, whether in non-human species or complex societies, and the reaction of Western European-descended Americans, in this case, is not unusual (Hoetink 1975, 13).

The uproar of Western European-descended Americans on the West Coast resulted in the passage of the Chinese Exclusion Act in 1882 by Congress. Its aim was "not to restrict immigration but rather to control it by preventing the entry of those who could not support themselves as well as 'convicts, lunatics, and idiots,'" (Fairchild 2004, 530; see also Kraut 1994, 83). The Chinese Exclusion Act was highly effective at curbing rates of immigration in the United States. In San Francisco alone, "the Chinese population was reduced by 46% from 1890 to 1900," (Yamato 1994, 37).

In 1891, as a response to the continuing public outcry over both the surging levels of other immigrant groups entering the labor force amidst an economic recession and the fears that immigrants were arriving and spreading transmissible diseases, the United States government made managing all immigration, not just Chinese immigration, a federal priority (Fairchild 2004, 529; Imperato and Imperato 2008, 228). In this, the government sought to "expand the reasons for exclusion that included contract laborers, political radicals, the insane, and those suffering from loathsome or dangerous contagious diseases," (Imperato and Imperato 2008, 229). In other words, the federal government was responding to the dominant culture's fears of immigrant competition for jobs and resources in addition to their collective fears of infectious diseases. Subsequently, additional laws were passed in 1903, 1907, and 1917 that provided further reasons why specific immigrant populations should be excluded from the United States (Imperato and Imperato 2008, 229; De Graauw and Vermeulen 2016, 1002).

However, it was not until 1924 that the United States government enacted some of its harshest immigration laws – largely in response to the loudest proponents of the eugenics movement. The Immigration Act of 1924 officially made national origin the basis for admission into the United States (Fairchild 2004, 528). In effect, this piece of legislature limited the number of immigrants that could enter the U.S. in a single year to

150,000. This Act specifically exemplified the success of the eugenics movement in the United States, especially due to its proponents efforts to maintain racial purity and wean out undesirable traits (and those who carried them) from the population, because it further restricted immigration "to 2% of the population of each 'race' recorded in the U.S. census of 1890, representing a deliberate attempt to dramatically limit immigration from southern and eastern Europe," (Fairchild 2004, 532). In addition to exemplifying the eugenics movement, the passage of the Immigration Act of 1924 demonstrated the paramount emotions of the nation at the time, including fear, hatred, and distrust of new immigrants.

The Immigration Act of 1924, although successful at curbing immigration rates as desired by the general American public, ultimately left a dark stain on American history because of its failure to make exceptions for refugees in serious crises. Fifteen years after the Immigration Act of 1924 was enacted, World War II was looming in Europe. In an attempt to flee persecution by Nazi-controlled Germany, 933 Jewish refugees sailed on the St. Louis towards United States soil. However, because the immigration quota for their racial designation had already been met, the ship was turned away and, eventually, nearly 30% of the ship's original refugees died in the Holocaust (Fairchild 2004, 532; Lawlor 2016, 7). The exclusionary nature of the United States during this period failed to help refugees who were truly in need. The United States government allowed hundreds of potential refugees on board the St. Louis to eventually die at the hands of Nazi-controlled Germany, which had truly embraced eugenics theory to the point of justifying ethnic cleansing through mass incarceration and genocide. The United States, in its embrace of ethnic exclusion during the early twentieth century, was not exceptionally distant from Nazi Germany's views on various ethnic groups in this period of history.

Medical Inspections of Immigrants

In addition to enacting legislation to limit further immigration, the United States federal government likewise sought to limit the spread of infectious diseases by immigrants who were admitted into the country. Generally, Western European-descended American citizens viewed immigrants as "an impoverished, disease-ridden lot," and an overall threat to public health (Markel 1998, 1024; also see Craddock 1995, 962; Craddock 1998, 67; Gardner 1999, 79; Imperato and Imperato 2008, 228). These views were firmly situated in eugenics ideology and the current medical theories of the time. Preventative medicine was rapidly gaining credence within the medical community and the general public due to advancements in germ theory, and therefore, "a new emphasis was now being placed upon individual bodies as the sources and spreaders of infection," (Marks and Worboys 1997, 8-9). Because immigrants were the source of new "individual bodies" entering the United States, they were repeatedly blamed for disease outbreaks in the late nineteenth and early twentieth centuries. To fight this perceived threat, "nativists baldly claimed in scientific medicine a weapon that white Anglo-Saxon Protestant civilization could use to defend itself against the intrusion of those it regarded as of inferior breed," (Kraut 1994, 5). Only later would they realize that immigrants were not, in general, the cause of disease in the late nineteenth and early twentieth century – they were merely the most susceptible because of the environmental conditions forced upon them by their low socioeconomic status.

When the federal government gained legal control from individual states to control immigration-related legislation in 1891, they also enacted policy that required the U.S. Marine Hospital Service to perform a medical inspection of every single immigrant to enter the United States; by 1912, this group of physicians had been renamed as the Public Health Service (Kraut 1994, 60; Imperato and Imperato 2008, 229; Fairchild 2004, 528). One of the largest immigrant medical inspection stations of this time was located at Ellis Island, which is where a vast majority of European immigrants entered into the United States along the East Coast. Public Health Officials at Ellis Island visually inspected all incoming immigrants for various diseases, including "tuberculosis, sexually transmitted disease, trachoma, favus, insanity and other mental disorders, and chronic conditions that might impede an immigrant from earning a living," (Imperato and Imperato 2008, 229; also see Kraut 1994, 55). Oftentimes, these medical screenings were humiliating experiences for immigrants entering the United States because they were forced to strip for the Public Health Officials inspections – typically in front of their fellow immigrants and family members (Krut 1994, 54-55; Fairchild 2004, 531).

Despite their widespread use throughout the early twentieth century, "the integrity and accuracy of these medical screening procedures were never seriously assessed," even though they were required for entry into the United States (Imperato and Imperato 2008, 327). The medical community's concern over individuals as vectors of disease was a relatively new concept, and it became widely implemented in U.S. immigration policy before it had a chance to be tested, further studied, and refined. Overall, though, the deportations of recently arrived immigrants were relatively rare during the Great Wave of

Immigration. Only between 1 and 2.5% of immigrants were deported once they entered the United States, or roughly 5,000-12,000 immigrants a year (Kraut 1994, 66; Imperato and Imperato 2008, 327). Nonetheless, out of those who were denied entry into the United States, medical reasons accounted for roughly 69% of deportation cases by 1916 (Kraut 1994, 4). After multiple widespread outbreaks of diseases such as polio and yellow fever in the late nineteenth century, the white, Western European-descended American public feared further exposure to disease by fresh immigrant arrivals (California State Board of Health 1886, 6, 34, 37, 39).

Yet, despite widespread beliefs at the time, immigrants entering the United States were not the sources of most diseases feared by Americans. In particular, white, Western European-descended American citizens intensely vilified Chinese immigrants. Chinese immigrants were frequently blamed for introducing yellow fever to the country, especially on the West Coast, even though the disease was, in reality, transmitted by mosquitos that bred wherever stagnant water was present (Imperato and Imperato 2008, 228). Furthermore, when smallpox outbreaks occurred in San Francisco in 1868, 1876, 1881, and 1887, newspapers and other official publications spread rumors that Chinese and Japanese immigrants had brought the sickness from their home countries (California State Board of Health 1886, 39; Craddock 1995, 957-958). Although smallpox did not have a high mortality rate compared to other infectious diseases of the period, it spread quickly and was both painful and deforming for infected individuals. This caused the American public to greatly fear the disease, further propelling their blame onto Chinese immigrants (Kraut 1994, 82; Craddock 1995, 960). However, in reality, Chinese and

Japanese immigrants could not have been solely responsible for smallpox outbreaks because cases were being reported in areas outside San Francisco where no Chinese immigrants were present. Chinese immigrants became the avenues of blame for the spread of diseases that permeated the wider culture. Likewise, immigrants from Mexico and Central America were also blamed for carrying diseases from their homelands (California State Board of Health 1886, 6).

Despite being discriminated against by the dominant culture, immigrants were not passive observers who were subjugated to American medical scrutinization. Many immigrants chose to hold on to their traditional healing methods that they brought with them from their home countries instead of embracing American biomedicine. For example, Western European-descended Americans heavily scrutinized Italian immigrants for being dirty, filthy members of society and for practicing traditional folk healing practices. Much of this stemmed from cultural differences in the understanding of health and disease between Western European-descended American citizens and Italian immigrants (Kraut 1994, 107; Marks and Worboys 1997, 229).

In the turn of the twentieth century Italy, health and disease were very closely tied to folk medicinal practices. As biomedically trained doctors were neither prevalent in Italy nor trusted, individuals relied on "applying folk remedies derived from a reservoir of folk traditions and customs and by consulting specialists such as witches, barbers, midwives, and herbalists," (Marks and Worboys 1997, 236). When Italians immigrated to the United States and continued practicing their traditional folk remedies, American citizens often saw this as justification that Italians were backward and unsophisticated in comparison to their own scientifically based healing practices.

Yet American opinions of Italian immigrants did not go uncontested by the Italian community. Dr. Antonio Stella, himself an immigrant from Southern Italy, was a prominent medical professional in the early twentieth century who was trained in both American biomedical practices and traditional Italian remedies. He argued that "Italian health problems [in American society] were a result of poor environmental conditions and poverty, not due to innate biological inferiority," as Americans liked to claim (Marks and Worboys 1997, 237).

Lastly, many immigrants also attempted to use the American legal system to defend their rights when they were violated (Kraut 1994, 107). For instance, many individuals from Mexico and Asia attempted to defend their rights by appealing to courts or public officials, but oftentimes only elite members of ethnic minorities had enough resources to fight for their rights in court (Cherny et al. 2011, 343). Even then, as in the case of Takao Ozawa, the existing social hierarchy was rarely in their favor.

Overall, the medical scrutinization of immigrants was a form of structural violence because it often stigmatized entire populations of individuals on little or no evidence and thereby further prevented the large ethnic community from obtaining the resources they needed to survive in their new country. In this case, "the stigma of disease can become a metaphor for already marginalized individuals, cultural defining them even further from society's mainstream," (Kraut 1994, 3). As previously argued, the denial of necessary resources for survival can negatively impact the health of individuals. To this effect, the stigmatization of immigrant populations by white, Western European-descended American citizens was self-fulfilling: *even if they were healthy upon arrival, subjugation to unhealthy environments due to segregation by the dominant population would eventually cause illness and disease in immigrant populations.*

San Francisco: A Case Study of Immigrant Health

Conflict between white, Western European-descended American citizens and immigrants was highly prevalent throughout the Great Wave of Immigration in San Francisco. As one of the most diverse regions in the United States due to large numbers of European, Asian, and Central American immigrants, San Francisco is the perfect case study to observe the relationships between social inequality and health, the changing color line, and the impact of structural violence on immigrant populations (Yamato 1994, 32; Marks and Worboys 1997, 229; Cherny et al. 2011, xv; Zimmer 2015, 89).

As stated, in the late nineteenth century, San Francisco and the state of California were one of the most ethnically diverse regions of the United States. When the state of California was seized by the United States from Mexico in 1848, San Francisco was a trivial collection of buildings and had only a small population of 850 to 1,000 individuals (Burchell 1978, 458). Over the next thirty years, San Francisco experienced tremendous growth, development, and expansion. By 1880, San Francisco had already become the ninth-largest city in the United States regarding both its population and manufactured goods, transitioning from a small town to a global financial hub of vast importance in only three decades (Dancis 1977, 80; Pamuk 2004, 294; Cherny et al. 2011, xvi).

However, the “exploitation of California’s natural resources, commercial agriculture, rail and water shipping, manufacturing, and other enterprises created extremes of wealth that were unusual in the West” at this time; this exploitation resulted in substantial socioeconomic inequality throughout San Francisco and the surrounding area (Cherny et al. 2011, xvi). This led to tension between those already with and without resources and newly arriving immigrants.

The growth and success of San Francisco, and moreover the state of California in general, during the late nineteenth century would not have been possible without the aid of new immigrants. The Gold Rush of the mid-nineteenth century attracted significant populations of Southern and Eastern European and Chinese immigrants, along with American-born citizens from other parts of the country, to the state. These immigrant groups eventually settled into California’s major urban areas, including San Francisco, once the sources of gold had dried up (Epstein 1990, 51; Craddock 1995, 959; Buzon et al. 2005, 10). By 1860, an estimated half of San Francisco’s population was foreign-born, while a quarter of the population consisted of ethnic minorities, including African Americans, Native Americans, Asians, and individuals form Mexico (Cherny et al. 2011, xv; De Graauw and Vermeulen 2016, 1002). Each of these groups of people helped to contribute to the economic success of San Francisco.

Despite the significant contributions of immigrants to San Francisco, however, the relationship between immigrants and Western European-descended Americans was heavily strained and fervently xenophobic. Throughout the late nineteenth century and early twentieth century, white, Western European-descended American citizens of San

Francisco were most likely to discriminate against immigrant groups of ethnic minorities, again because of the eugenics movement and racial ideologies that stemmed from slavery practices. Instances of discrimination against various ethnic immigrant groups abounded, especially against Chinese, Japanese, Irish, Italian, Southern European and Mexican immigrants (Keller 1878a; Hall 2013, 44). This discrimination was widely publicized in the media and official public reports, such as the California State Board of Health Biennial Reports, consumed by Western European-descended Americans at this time. Overall, anti-immigrant ideology caused immigrants to be excluded from certain jobs, limited to low-wage work, segregated into urban areas and faced with overpopulation and limited resources (Dancis 1977, 84; Craddock 1995, 960; Gardner 1999, 81; Berglund 2005, 5; Buzon et al. 2005, 12; Wang 2008, 32; Bakhtiari 2018, 140).

Asian Immigrants

In particular, individuals from China constituted the largest immigrant population group in San Francisco throughout the late nineteenth century. Various historical records and bioarchaeological cranial analyses indicate that approximately ninety percent of Chinese immigrants came from the Guangdong region of South China (Schmidt et al. 2010, 17). These individuals were mostly men who often sent money back home to families (Epstein 1990, 52). Some chose to stay in the United States, but many of them eventually returned home to China (Harrod and Crandall 2015, 148).

Chinese immigration to America largely began during the 1840s because of the discovery of gold in parts of California (Epstein 1990, 51; Buzon et al. 2005, 10). The hope of discovering gold led to rapid population growth; however, by the 1860s, gold was mined at a much slower rate (Craddock 1995: 959). With no further income, Chinese immigrants had to look elsewhere to earn a living. Many of them turned to the railroads, which were extensively expanding throughout the United States during this time although the work was both difficult and dangerous. By 1867, Chinese laborers comprised ninety percent of the Central Pacific Railroad's workforce (Craddock 1995, 959). That same year the railroad was completed, yet again leaving many Chinese immigrants without work.

Outside of agricultural work, San Francisco represented the best avenue for job opportunities in the area. Typically, when arriving in a new country, immigrant groups tend to live in tightly congested ethnic clusters comprised of networks of businesses and restaurants owned by members of the same group (Craddock 1995, 960; Pamuk 2004, 288; Berglund 2005; 5). When Chinese immigrants began moving into San Francisco, they formed their own ethnic cluster to maintain cultural traditions in a foreign land. This is generally considered to be an adaptive strategy used by many immigrants to survive in a new country (Zhou and Logan 1991, 388). For its inhabitants, Chinatown offered "a relatively safe haven as well as networks of familiar people, institutions, goods and services," and, because of this, nearly two thirds of Chinese immigrants in San Francisco lived in Chinatown (Berglund 2005, 5; also see Li 2012, 39). Recognized as an official city district in the 1850s, San Francisco's Chinatown grew to a population of 23,000 people by 1870 (Epstein 1990, 52; Li 2012, 38). Yet even though the population grew substantially through the late nineteenth century, Chinatown was unable to expand past the original ten city blocks where it organically grew due to the unwillingness of local government officials and nearby landowners to grant additional land to Chinese immigrants (Li 2012, 38). Later, after the passage of the Chinese Exclusion Act, Chinese individuals were barred from owning property and were forced to continue renting in Chinatown, where they were already established (Li 2012, 39). Therefore, although the inhabitants of Chinatown originally chose to self-segregate from the rest of the city, subsequent city government declarations prevented them outwardly expanding the neighborhood.

As San Francisco underwent both rapid population and economic growth during this time, Chinese immigrants were mostly welcomed for their additional labor, although they still faced discrimination by Western European-descended Americans (Craddock 1995, 959). By 1875, however, San Francisco began to experience its first economic recession. The recession caused both unemployment rates and poverty to increase (Cradock 1995, 960). During this time, the Chinese faced heightened and outward racial discrimination in the form of legislation and violence by white San Franciscans because of the competitive job market – even though they had contributed to San Francisco's economic well-being (Keller 1878a; Epstein 1990, 51).

Prior to the recession, Western European-descended American's already demonstrated documented distaste for Chinese immigrants. In 1871, the California State Board of Health composed its first annual report discussing major health threats to the population; specifically, Chinese immigrants were targeted. At this point, Chinatown was already a well-established in neighborhood San Francisco. The Board of Health viewed this community as a health threat to the entire city, and stated in their first biennial report:

I have not yet spoken of the greatest infringement of the laws of health to be met with in the Chinese quarters, and which calls for immediate redress. I allude to the almost absolute absence of ventilation. In the underground purlieus there is no means whatever for the admission of air, save through the common cellar opening or entrance. The domiciles above ground are not better, because the windows are too few and small in proportion to the occupants, and besides they are never left open. The consequence of this is that the stench of the premises is horrible. (California State Board of Health 1871, 47)

However, much of the "absence of ventilation" and horrible stenches described by the Board of Health were due to the clustering of Chinese immigrants into a confined portion of the city, which they considered safe from racial discrimination but were unable to expand upon as their population grew. In this way, Chinatown was a self-fulfilling prophecy: as Chinese immigrants were prevented from expanding as their population grew, their quality of life diminished.

Additionally, the first biennial report of the California State Board of Health discussed the fears held by Western European-descended Americans that "racial" groups were interacting in inappropriate measures with white populations and were, therefore, violating the social hierarchy. The color line, as discussed in the previous section, was the hypothetical barrier that prevented non-white individuals from achieving the same status as Western European- descended Americans. In their report, the California State Board of Health moved to calm Western European-descended American's fears that immigrants, African Americans, and indigenous populations would breach the color line through interbreeding with white populations.

For my part, whatever of truth there may be in Darwin's theory of natural selection to the contrary, I am not one of those who fear that an intelligent people, like ours, would run any serious risk of race degradation from intermixture with the Chinese. Our experience, as a nation, is already valuable to this point, and goes to show that although we have been brought continuously into close relations with the Indian and the negro, still the elements of assimilation have proved too discordant to permit any permanent intermixture with

> either of these peoples. The negros number about one-tenth of the population of the United States, and yet the fact of miscegenation has been but local, and even then so partial as to be quite inappreciable. Still, the presence of the negro race in our Southern States has been the *casus belli*, and other deplorable troubles, which we are not likely soon to override. In the Spanish colonies on this continent, the European (Latin) race mingled, as is well known, with the Indian and the African; and we need nothing more than the present history of Mexico and Central America as an instructive commentary on the fact. (California State Board of Health 1871, 48)

Besides appearing in public health reports, anti-Chinese sentiment during this time was widely circulated through the media in San Francisco, the West Coast, and the United States as a whole through the *WASP*, a weekly magazine that was first printed on August 5, 1876 by Francis Kobel (Hall 2013, 45). The *WASP*, which stands for White Anglo-Saxon Protestant, circulated rhetoric against many groups of people, including "wealthy railroad managers, Irish laborers, Chinese immigrants, indigenous people, Mormons, Mexicans, and African Americans," (Hall 2013, 44). As previously stated, fears that an influx of Chinese immigrants would take Western European-descended American's jobs and resources increased once an economic recession took hold of the region. The *WASP*'s articles from this time resonated with those fears. In an article printed in March 1878, George Keller discussed how the famine in China would send millions of Chinese to the United States as a swarm of "yellow grasshoppers" to decimate U.S. food reserves; ultimately, Keller used his platform to argue that "it is time that steps were taken to avert this danger, unless, indeed, we are content to wait the day of our destruction as a nation," (Keller 1878a).

In that same year, images frequently appeared in the *WASP* that portrayed the damage Chinese immigrants were perceivably causing to American society. Figure 1 demonstrates an illustration that appeared in the *WASP* on August 10th, 1878 (Keller 1878b). In this image, a well-dressed wasp, standing in the bottom right corner, watched while dark and evil-looking Chinese men approach the city of San Francisco in a wagon driven by the Board of Health. The wagon's wheel states

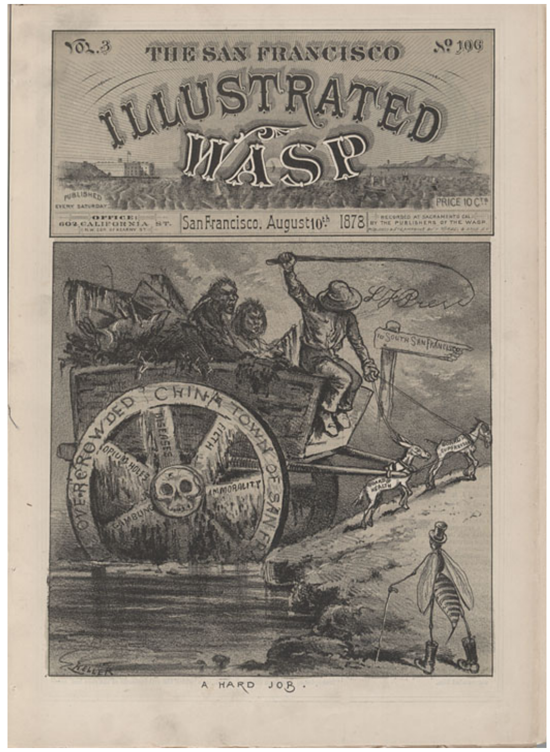

Fig. 1. Image by George Keller titled "A Hard Job" from *The Illustrated WASP*, August 1878.

"Overcrowded Chinatown of San Fra-" and then on the wheel spokes: "gambling, opium houses, disease, filth, immorality," (Keller 1878b). This image represents fears held by Western European-descended American citizens (the wasp in the image) regarding Chinese immigrants, and their unappealing contributions to the city, during the late nineteenth century.

With the passage of the Chinese Exclusion Act of 1882, the flow of Chinese immigration into the United States was halted, and over time, the Chinese population in San Francisco began aging and decreasing in size (Epstein 1990, 52; Wang 2008, 30). The decrease in the Chinese population allowed economic opportunities to emerge for other immigrant groups. Unlike the Chinese, Japanese immigrants did not begin arriving in California until the 1880s (Wang 2008, 30). Although their population size was never comparable to Chinese immigrants, Japanese immigrants significantly contributed to San Franciscan culture during the close of the nineteenth century. Many of them had been inspired to migrate to America because of the pervasive image of the "American Dream," the idea that through hard work, one could move from rags to riches by the accumulation of wealth and status (Sueyoshi 2005, 78). This often involved Japanese immigrants adopting American customs more readily than their Chinese counterparts; to pursue the American dream, many Japanese immigrants realized they needed to assimilate into larger American society – in other words, they needed to cross the metaphoric color line.

However, Western European-descended San Franciscans strove to control Japanese immigrants, especially through the perception of the Japanese image. Western European-descended San Franciscans often had a strange fascination with Asian culture, especially the Japanese kimono for its perceived femininity (Sueyoshi 2005, 81). In the late nineteenth century, the meaning of womanhood was changing in San Francisco, and throughout the rest of America, because more women were entering the workforce. In this tumultuous time for the perceived identity of white women, Japanese women and their kimonos were hyper-feminized and valued for embodying the traditional woman's role. When Japanese immigrants failed to appear "Japanese" in the traditional sense, Western European-descended San Franciscans were disappointed (Sueyoshi 2005, 89). Japanese immigrants were already trying to appear American by adopting Western dress, and Western European-descended San Franciscans' fascination with traditional Japanese female clothing prevented them from achieving integration with American society.

Eventually, the Japanese were barred from becoming "too American" through legislation; in 1913, the Alien Land Act prevented Japanese immigrants from owning land or leasing agricultural land in California, and in 1922, the Supreme Court case with Takao Ozawa proved Americans were not ready to extend their citizenship to non-white immigrants (Van Nuys 1994, 2; Sueyoshi 2005, 91; Lee and Bean 2007, 565).

Because of their different intentions, Chinese and Japanese immigrants interests' were often pitted against each other. Their economic interests often overlapped as Japanese immigrants gradually displaced Chinese contractors and laborers after the Chinese Exclusion Act of 1882, increasing competition between the two groups (Wang 2008, 30-31). Furthermore, Japanese immigrants were often fearful of white Americans' attempts to group them as Asian immigrants because the Chinese were already experiencing heavy discrimination (Sueyoshi 2005, 78; Wang 2008, 30). Both groups were forced to live in close proximity through shared segregated living spaces and schools (Van Nuys 1994, 2; Wang 2008, 32). Despite their efforts, Japanese immigrants failed to position themselves as Americans in the eyes of Western European-descended San Franciscans, who strongly felt Americans were white and Japanese and Chinese immigrants were not (Sueyoshi 2005, 78). In short, white racism defined tensions between Chinese and Japanese immigrants, preventing the two groups from sharing a sense of unity as Asian immigrants (Wang 2008, 34 & 50). This paralleled the rest of American society, which upheld a strong ideology of national homogeneity in the late nineteenth century that continued into the twentieth century (Craddock 1995, 960; Daniels 1997, 10; Imperato and Imperato 2008, 228; Bakhtiari 2018, 140).

Non-Western European Immigrants

Like immigrants from China and Japan, non-Western European immigrants also faced discrimination when trying to incorporate themselves into San Franciscan society. During the late nineteenth century, the largest groups of European immigrants to San Francisco were the Irish. Their steady stream of immigration to the United States was primarily caused by the Irish potato famine from 1845-1852 and persistent British colonialism efforts, which became arguably one of the worst human mortality events in modern history (Gerber 2014, 149; Bakhtiari 2018, 143). In the years before the famine, the poorest members of Irish society were already periodically starving because, and since the eighteenth century onward, they were primarily dependent on the potato for subsistence. Once the potato blight began spreading in 1845, it destroyed the only food source for a majority of the population (Smith 2011, 39). The ensuing starvation caused Ireland to lose a quarter of its population through a combination of death, disease, and mass emigration (Smith 2011, 47, 50; Gerber 2014, 141).

When they arrived in the United States, most Irish immigrants remained in the first cities they settled in on the East Coast (Burchell 1978, 458). Because of the poverty and conditions of famine they had left behind, many of them arrived destitute (Craddock 1998, 67). As time went on and the East Coast grew crowded, many Irish immigrants began migrating westward. By 1880, a United States census estimated that close to 30,700 Irish-born immigrants were living in San Francisco (Burchell 1978, 458; Gardner 1999, 82). Yet, as previously discussed, Western European-descended Americans did not consider the Irish immigrants as “white.” The Irish were repeatedly marked as both racially and religiously inferior to other Euro-Americans throughout the United States, which added another xenophobic element to the already racially charged nineteenth century San Francisco (Gardner 1999, 81; Waters 2000, 1736; Lee and Bean 2007, 566; Paddison 2009, 505; Cherny et al. 2011, 64; Bakhtiari 2018, 140).

Unlike the racial tensions between the Chinese, Japanese, and Western European-descended San Franciscans, the animosity between white San Franciscans and the Irish stemmed from centuries of tensions in Europe between Protestants and Catholics (Paddison 2009, 505; Cherny et al. 2011, 64). After the American Civil War, San Francisco began experiencing its own heightened anti-Catholic movement as the conflict between Protestants and Catholics migrated westward to the New World. To Protestant Christians, Catholics were marked as religiously and racially inferior, and none more so than Irish Catholics (Paddison 2009, 505). Again, Irish workers were initially assigned non-white racial identities, viewed as dirty vermin, and faced discrimination similar to the Chinese and Japanese (Gardner 1999, 81-82).

By the 1880s, the anti-Chinese movement had developed steam after the economic recession a few years earlier. Low-skilled, low-paying jobs had amplified competition between white and Chinese workers (Craddock 1995, 960; Gardner 1999, 77). Irish immigrants saw the anti-Chinese movement as an opportunity to establish their credentials as white Christians, and consequently, new camaraderie developed between Protestants and Catholics, who temporarily settled their differences in face of the Chinese "threat" (Dancis 1977, 78; Paddison 2009, 544). After much effort, Irish immigrants were able to cross the ideological color line and reimagine themselves as white, at least in comparison to Chinese immigrants, and the Irish joined Western European-descended San Franciscans in opposition to non-white immigrant competition for jobs (Dancis 1977, 75).

Similarly, Italian immigrants also had a difficult time assimilating into turn of the twentieth century San Franciscan society. Like the Irish, Italian immigrants "were often treated as non-white when they arrived, [and] allied themselves with neighboring [Native Americans], working, socializing, and even praying together. The Italians' later efforts at assimilation sometimes meant distancing themselves from their [Native American] friends," (Cherny et al. 2011, 342). Again, as with Irish immigrants, the effort of crossing the hypothetical black-white color line often pitted minority groups against one another. Overall, the upward mobility of European immigrants explicitly excluded black Americans, Asian immigrants, and indigenous populations – sometimes even at their expense (Bakhtiari 2018, 141).

Indigenous and Mexican Populations

However, immigrant groups were not the only ethnic minorities discriminated against by Western European-descended San Franciscans in the late nineteenth and early twentieth centuries – indigenous groups also suffered from unequal access to resources. Although not a part of this thesis' scope, indigenous group faced comparable, if not worse, circumstances than immigrant groups. Throughout the middle and latter half of the nineteenth century, "as European Americans moved into the province taken from Mexico, they redefined the region as 'American,'" (Cherny et al. 2011, 4). This process was often inherently violent towards indigenous peoples and immigrants from Mexico.

European Americans sought to erase their languages and histories and replace them with "white Protestant culture," (Cherny et al. 2011, 18). By the twentieth century, they had mostly succeeded.

The Consequences of Racist Ideology on Immigrant Health in San Francisco

The interactions between these groups and American-born citizens, who maintained tight control over who exactly could be considered a citizen, defined much of San Francisco's late nineteenth and early twentieth century histories. In turn, these interactions also significantly impacted the health of the city's inhabitants – especially the health of those who were not defined as white.

As socioeconomic position determines one's ability to access resources, individuals with low socioeconomic status, therefore, cannot access substantial resources required to maintain healthy lifestyles. In general, "immigrants are disproportionately more likely to be in poverty than their native-born American counterparts," (Yang 2010, 340). This was especially true in turn of the twentieth century San Francisco.

People who lived in the poorer sections of the city, such as Chinatown, lived in harsh environments due to constructed overpopulation, which led to "dirt, filth, noise, overcrowding, and bad odors that pervaded almost every aspect and activity of daily life," (Markel 1998, 1021; see also California Board of Health 1871). People who lived in the poorer sections of the city did not have the necessary resources or support from city government to maintain healthy, clean environments to prevent the spread of disease. For instance, "sewage systems, particularly in the poorer districts, were unreliable and often backed up into already soiled and filthy streets," (Markel 1998, 1021). Furthermore, their lack of resources also led to overcrowding of shared housing space, which also contributed to the spread of diseases in immigrant communities.

The working environments of immigrants were hardly better than their living conditions. Foreign-born workers often had to work in the worst, most unhealthy conditions in the city. “Jobs left for anyone deemed not white or not white enough were assumed to be deservedly inferior, with inferior working conditions” by white, Western European-descended American citizens (Derickson 2018, 44). This frequently resulted in exposure to toxic chemicals in immigrant groups working these allegedly “inferior” jobs. For example, in early twentieth century sweatshops, Eastern and Central European immigrants, including adults and children, were exposed to dangerous substances that included arsenic, silica, lead, nicotine, and other ergonomic stressors (Derickson 2018, 41). Italian and Eastern European immigrants often engaged in specifically hazardous occupations “in mines, steel mills, blasting, excavations, besides all sorts of dusty and unhealthy trades,” (Derickson 2018, 41). Lastly, industrial warnings and cautions were rarely posted in the languages of immigrant workers, which prevented them from understanding the extent of the risks in their working environments (Derickson 2018, 42).

Furthermore, the socioeconomic status held by most immigrant groups often prevented them from taking action against their employers. Specific ethnic immigrant groups were frequently barred from joining labor unions, due to American-born citizens’ fears of immigrant economic competition that would have otherwise been able to assist them in their efforts to achieve healthier working conditions.

Public health records from this time can provide evidence of the health of immigrants and individuals with low socioeconomic status in San Francisco during this period. According to the California Board of Health report for 1884-1886, diseases afflicting the people of San Francisco included typhoid fever, cholera, diphtheria, consumption (tuberculosis), marasmus, and meningitis (California State Board of Health 1886, 62, 184). In instances of diarrhea, dysentery, fevers, phthisis pulmonalis, pneumonia, and other respiratory illnesses especially, immigrants had similar or more prevalent instances of death compared to non-immigrants (California State Board of Health 1886, 108-109). These diseases were also prevalent in other areas of the United States at this time, meaning that immigrant populations were not the sole carriers of disease – the entire United States population was (Buzon et al. 2005, 10). Furthermore, San Francisco's population boom significantly contributed to the urban environmental conditions of the time. Therefore, it was the overcrowded and sub-par living conditions that were responsible for the spread of diseases during this period – not the increasing influx of immigrant groups.

Besides having a direct impact on their physical and mental health, the marginality of immigrants imposed upon them by American-born citizens also placed immigrants at a disadvantage when seeking access to medical and health care systems in their new country (Marks and Worboys 1997, 11). The turn of the twentieth century San Francisco was saturated with opportunities for infectious diseases to spread from person to person, especially in the dirty, overcrowded areas inhabited by a majority of immigrant groups. Reoccurring epidemics at this time included outbreaks of "diphtheria, smallpox, and whooping cough, [while] cholera outbreaks in the summer further caused thousands of babies to die of dehydration" (Markel 1998, 1021). Therefore, due to both their environmental conditions and socioeconomic status, it is not surprising that new immigrants in the early twentieth century "had higher childhood mortality rates than the U.S.-born white population," but, over time and through longer periods of residence and assimilation attempts, saw improvement in this measure (Bakhtiari 2018, 139).

However, despite being faced with limited access to resources and discrimination, immigrant groups were still able to provide themselves with some health care to diminish the impact of their unhealthy living and working conditions. For instance, Italian immigrants continued to use traditional folk medicine once they had arrived in the United States (Marks and Worboys 1997, 241). This allowed them to both maintain ties to their homeland and provide themselves with remedies for ailments associated with unhealthy living conditions. Likewise, Chinese immigrants, who had been "systematically excluded from participating in social and political institutions in San Francisco and California since they first arrived in the U.S., including health care institutions," had to turn to each other, typically through traditional Chinese physicians and mutual aid societies, to receive health care (Yang 2010, 344).

Overall, white, Western European-descended American citizens throughout this period heavily guarded assimilation into the dominant American culture in San Francisco. The strict enforcement of who could and who could not assimilate into American society in late nineteenth and early twentieth century San Francisco was a form of structural violence because white, Western European-descended American citizens prevented the various ethnic immigrant communities from obtaining the resources they needed to survive in their new country.

Today, modern immigrants have a strikingly different pattern of health than immigrants in the late nineteenth and early twentieth centuries. Many immigrant groups now “exhibit better-than-expected health upon arrival” to the United States “despite other detriments of poor health, such as low socioeconomic status and experiences of discrimination,” (Bakhtiari 2018, 138). This likely due to several factors, such as directional selection factors during the migration process that favor healthy individuals or healthier cultural norms in immigrants’ home countries, such as better diets and more active lifestyles, compared to the United States (Bakhtiari 2018, 139). However, after their arrival and adoption of modern American lifestyles, many immigrants experience deteriorations to their overall health the longer they are exposed to American society, compared to immigrants of the past, who often experienced better health due to increased access to resources upon assimilation to American society. These changes to modern immigrant health statuses are largely due to the “adoption of unhealthy behaviors, such as smoking [to deal with stress], a sedentary lifestyle, and unhealthy diets,” along with the racial tensions that still exist in American society today (Bakhtiari 2018, 139). Assimilation patterns in modern times have drastically different outcomes on immigrant health than they did in the past. In turn of the twentieth century San Francisco, assimilation meant overcoming portions of the social inequality imposed upon them by white, Western European-descended American citizens because of their ethnic background or the color of their skin.

The history and hardships of these immigrants are truly important to remember, especially in the United States' current climate of fear and distrust of incoming immigrant communities. Without remembering our history, the United States will continually repeat the mistakes of the past, such as the rejection of the St. Louis and the eventual deaths of hundreds of Jewish refugees at the hands of Nazi Germany. Immigrants are not a corrosive force in our country – instead, the most damaging force in the United States is the persistent racist mindset of the dominant population that paves the streets with inequality.

Health and Human Remains

Although these populations from San Francisco died decades ago, their lived experiences, including their health, can still be discovered. Besides public health records or reports, one method for assessing the health of people in the past is through the osteological analysis of skeletal remains. Because skeletal remains are made of "living tissue that responds to various types of environmental stresses experienced by the body during life, human skeletal remains…can provide a wealth of information," on past experiences (Lambert 2000, 169). In this thesis, osteological methods were used to compare the health of both immigrants and American citizens who died in the early-mid twentieth century San Francisco.

In bioarchaeology, a subfield of biological anthropology that employs osteological methods, environment and culture are known to biologically manifest themselves in human remains. Bioarchaeologists uphold a biocultural view of the past, which signifies that “a society’s technology, social organization, and even its ideology [are understood to] play a major role in inhibiting or creating opportunities for biological events such as patterns of disease,” (Armelagos et al. 2003, 58). Namely, both biological processes and culture shape lived experiences, which in turn leave traces in skeletal remains. Researchers have used this understanding to investigate the health of past populations and to reconstruct both the environmental and cultural processes that impacted them in life (Goodman et al. 1984a, 271; Goodman et al. 1984b, 15; Steckel et al. 2002, 142; Armelagos et al. 2003, 58; Wright and Yoder 2003, 44; Buzon et al. 2005, 2; Sabbah et al. 2009, 516; DeWitte and Stojanowski 2015, 398; Zuckerman and Crandall 2019, 161). Therefore, because of this biocultural emphasis, bioarchaeology is a pertinent means for understanding cultural inequality and its relationship to health in the past.

One method that is particularly useful in understanding inequality in past populations is measuring the occurrence of pathological lesions, evidence of infectious diseases, and stress in human remains to determine both individual and population health. When bioarchaeologists measure the health of past populations, it is important to note that they can do so because it has been repeatedly observed that the body produces predictable and measurable responses to chronic and acute stressors from diseases (Goodman et al. 1984b, 15; Wood et al. 1992; 353, Gerber 2014, 149; Marklein et al. 2016, 208). Not all diseases leave behind evidence of their existence, though. Despite significant evidence that infectious diseases have impacted human populations throughout the entire course of their evolutionary history, diseases rarely leave direct evidence in skeletal remains (White and Folkens 2005, 317). However, since individuals of lower socioeconomic status are less likely to be able to afford medical intervention when exposed to disease, they are more likely to exhibit pathological skeletal manifestations than their corresponding upper-class counterparts.

Studies on living populations in both the United States and the United Kingdom have shown a general trend for "people of ethnic minorities to have poorer general and oral health indicators than non-ethnic minority populations," (Sabbah et al. 2009, 516; also see Link and Phelan 1995, 81; Hankin and Wright, 2010, s11; Nystrom 2011, 165; Acevedo-Garcia et al. 2012, 2060; Bakhtiari 2018, 139). In archaeological studies on past populations, it has been observed that the combinations of low socioeconomic status, racial harassment, and discrimination within a society intersect and have a profoundly negative impact on individual and population health (Sabbah et al. 2009, 516; Amoroso et al. 2014, 467). Positive environmental conditions, which include cultural impact, have been linked to longevity in past populations, while negative conditions, such as famine or severe stress, can leave permanent physiological changes on the body (Goodman et al. 1984b, 15; Lambert 2000, 169; Reeves 2000, 85; Gerber 2014, 149). Therefore, this thesis hypothesizes that individuals who immigrated to the United States will have higher markers of poor health than non-immigrant Americans.

Nevertheless, issues with data representation occur when bioarchaeologists directly relate observed individual pathologies in human remains when reconstructing the overall populational health of past societies; these issues are known as the osteological paradox. In surface-level observations, it is often assumed that there is a direct association between skeletal pathologies and mortality rates in past societies (Wood et al.

1992, 343; Steckel et al. 2002, 147; DeWitte and Stojanowski 2015, 400; Sołtysiak 2015, 569). Yet when dealing with archaeological populations, the issue becomes more complicated because archaeologists never have a complete sample of all the individuals "who were at risk of disease or death at a given age," but only a small sample of the individuals who did die, which are the individuals preserved in the archaeological record (Wood et al. 1992, 344; see also DeWitte and Stojanowski 2015, 398). In other words, "the abundance of lesions of a particular condition seen in a cemetery sample does not directly reflect its abundance in the living population at any given point in time," and therefore poses the question: "does a skeleton without evident lesions represent a healthy person or a weak individual who perished at the first exposure to a pathogen?" (Wright and Yoder 2003, 45).

Three conclusions, as well as potential solutions, have been made by bioarchaeologists regarding the osteological paradox since it was formally brought to the discipline's attention in the 1990s. To begin with, bioarchaeologists have deemed that it is impossible to directly infer epidemiological rates from archaeological samples because the total number of exposures cannot be accounted for, only the people who died from exposure (Wood et al. 1992, 345). In other words, although some individuals have no evidence of disease, this does not necessarily conclude that they were healthy in life – they may have succumbed to their illness too quickly for the body to respond osteologically. Secondly, individual cases provide minimal information and only comparative studies based on multiple pathologies can begin to reconstruct the health of past populations (Wood et al. 1992, 345; DeWitte and Stojanowski 2015, 402). Lastly, to analyze skeletal lesions to assess population health in light of the osteological paradox, bioarchaeologists proposed solutions that include increasing the sample size of the observed population, as well as actively assessing multiple pathological elements to more accurately represent the health of past populations (DeWitte and Stojanowski 2015, 409). This thesis will address these proposed solutions to the osteological paradox by including a sample size of at least one hundred individuals, therefore preventing any single individual's health from overshadowing the population, and by assessing multiple pathological elements to provide broader insight into the health of late nineteenth and early twentieth century immigrants to San Francisco.

In bioarchaeology, there has also been a long history of examining human remains to reconstruct the lifeways of populations in the past. Since the late 1980s, interdisciplinary interest in the study of human remains has abounded, especially within history, medicine, and economics (Steckel et al. 2002, 142; Wright and Yoder 2003, 44). This interest culminated in a study by Steckel et al. to document and analyze the history of health in the Western hemisphere through the analysis of archaeological and historic human remains (Steckel et al. 2002, 142). This large-scale study marked the first serious multidisciplinary effort to document the history of human health in North and South America over nearly six thousand years.

Overall, this study examined the general health of 12,520 individuals from various populations; about two-thirds of these individuals had Native American ancestry, while the remaining individuals were either Euro-American or African-American (Steckel et al. 2002, 143). The results of this study found that Euro-American populations in the Western hemisphere had high instances of porotic hyperostosis and cribra orbitalia, both of which are indicative of anemia or nutritional deficiencies, while African-Americans had the highest levels of cribra orbitalia and, overall, the worst health of any North American population as a result of the conditions many of them experienced through slavery and the resulting racial oppression (Steckel et al. 2002, 149). Although this study did not specify health conditions for Asian-American populations living in the Western hemisphere, it did identify that groups living in urban cities scored two standard deviations below the health levels of hunter-gatherer populations (Steckel et al. 2002, 150). This indicates that urban environments, where populations are tightly condensed in close living quarters, are more risky for a population's overall health.

Likewise, bioarchaeological studies have used both the historical record and osteological evidence to analyze the health of African Americans, their quality of life, and the roles they have played in the United States' post-contact era. These studies have emphasized a biocultural approach, which "combines cultural and social historical information with the demography and epidemiology of archaeology populations to verify, augment, or critique the socioeconomic conditions and processes experienced by past human communities," (Blakey 2001, 409). Studies on African American groups in early U.S. history have, in particular, focused on the impact that slavery and racial segregation had on both individual and populational health. For instance, one study examined the remains of mid-nineteenth century enslaved plantation workers near Charleston for evidence of malnutrition and disease. These individuals had especially high rates of anemia and infection, which was comparable to individuals analyzed from similar sites in

Maryland, Virginia, and the Carolinas (Blakey 2001, 403, 405). This indicates the harsh lives experienced by slaves in early American history due to racial discrimination. Another study, which analyzed the African Burial Ground in New York City dating to colonial America, demonstrated the modern continuation of ethnic tensions when control of the site was disputed between archaeologists and the African American descendant community, who, after considerable debate, successfully designated the site as a National Historic Landmark (Blakey 2001, 410). Eventually, analysis of the cemetery found high levels of anemia and hypoplasia amongst the population, indicating periods of famine that occurred during these individuals' childhood. These studies on Africans in early American history have been important because they have driven significant discussions of "human rights, apologies, and reparations," (Blakey 2001, 414).

Lastly, further evidence for the implications of poor living conditions on individual health was analyzed through the bioarchaeological examination of remains from a late nineteenth century cemetery in San Francisco. Working-class European and Chinese immigrants predominately used this cemetery, originally known as Golden Gate Cemetery, between 1868 and 1906 (Buzon et al. 2005, 1). The remains of these individuals were examined to evaluate the quality of life they experienced in the late nineteenth century. This cemetery has proved to be one of the largest collections of nineteenth century skeletal remains from the western United States and provided important data on the health of San Francisco's immigrant and indigenous populations.

Upon the examination of the skeletal remains of these individuals, at least 80% of the individuals had lost teeth before death and 50% exhibited evidence of linear enamel hypoplasia (Buzon et al. 2005, 4). Linear enamel hypoplasia is a dental defect that consists of horizontal lines appearing in the teeth due to nutritional deprivation or systemic metabolic stress during adolescence. This, combined with tooth loss before death, is evidence of significantly poor oral health within this population. During this period, “dental care was not widely available, and the low socioeconomic status of the population makes it unlikely that they could afford the service” anyways (Buzon et al. 2005, 8). Besides dental evidence, both porotic hyperostosis and cribra orbitalia were present in three and eight percent of the population, respectively. The presence of these pathologies, which can be found on top of the skull or in the eye orbits, is evidence of anemia or nutritional distress for long periods. Although these are not high numbers, these pathologies are only generally found in severe cases. All of these pathologies, including the presence of tooth loss before death, linear enamel hypoplasia, porotic hyperostosis, and cribra orbitalia, are indicative of poor nutrition in these individuals, which is expected because during this time, economic hardships made “nutritious sources of food, like vegetables, very expensive – a luxury only for the rich,” (Buzon et al. 2005, 10). Consequently, this cemetery provides hard, archaeological evidence of San Francisco’s rampant social inequality that reigned during the late nineteenth and early twentieth centuries. The evidence also upheld historical representations of San Francisco’s extensive overpopulation and poor living conditions.

This discussion on both the biological and cultural theoretical frameworks in anthropology is vital to this thesis. Although there is already historical and bioarchaeological evidence on the quality of life immigrants to San Francisco experienced in the late nineteenth century, the implications of racism are rarely discussed concerning low socioeconomic status as evident in human remains. Western European-descended Americans living in the late nineteenth and early twentieth century San Francisco maintained racist ideologies when faced with an influx of numerous immigrant groups who sought to make their living in the city. Western European-descended Americans attempted to solve their issues with diversity by forcing immigrant groups into segregated, overcrowded corners of the city, which created numerous vectors for disease to easily spread between immigrant populations of low socioeconomic status. Additionally, immigrants' low socioeconomic status, often the result of the migratory process and racial identification once they arrived in San Francisco, made diseases more likely to manifest themselves in their skeletal remains because many could not afford access to medical intervention; this trend has been observed in both modern and archaeological populations. Furthermore, because bioarchaeologists have identified that the body responds to disease in predictable ways, trained osteologists can identify specific instances of disease in skeletal remains. However, because of the osteological paradox, a large sample size and multiple pathologies must be considered to assess the health of immigrants concerning race and the impacts of socioeconomic status in late nineteenth and early twentieth century San Francisco. This thesis will supplement the existing scholarly literature in bioarchaeology by focusing on how culturally persistent racist ideology and social inequality are indicated pathologically in skeletal remains.

CHAPTER THREE: Methods

Generally, people in the past without significant power or access to resources rarely have their voices included in the historical record. However, aspects of their lives can be revealed using osteological methods. Osteology is one of the sub-disciplines of biological anthropology; its main objectives involve the analysis of skeletal remains to determine evolution, past behaviors and diets, and, as in the case of this thesis, the health of past populations. The population analyzed in this thesis lived and died in San Francisco in the early-to-mid twentieth century. To estimate the health of these individuals, including immigrants and Western European-descended Americans, their skeletal remains were osteologically analyzed for pathological differences based on sex, immigration status, and ancestry.

The skeletal remains analyzed in this study reside in the University of Iowa Stanford Collection (UI-SC), a part of the University of Iowa Office of the State Archaeologist (OSA), located in Iowa City, Iowa. According to the OSA, the collection of over a thousand individuals, again both immigrants and American citizens, were, in life, "either too impoverished to afford a funeral or had no family to claim them so [their remains] were made available for medical school dissection," at Stanford University, California. The fact that these individuals were used as medical cadavers hints at their low socioeconomic status in life because marginalized groups had little agency to decide what happened to their remains in death (Nystrom 2011, 169).

Out of the approximately 1,100 individuals in the UI-SC, a random sample of 144 individuals was chosen for this project. Although individuals were numbered in the UI-SC, number generators were not used in sample selection. Instead, every third individual was selected to be included in the sample from a specific starting point. This selection could have led to potential bias in the sample due to an organization scheme used by the collection curators, but this was unknown to the researcher. The sample was larger than what was originally intended for this study because many of the individuals' remains were fragmented and, therefore, certain conditions could not be analyzed.

As discussed in the previous chapter, a large sample size comprising at least one hundred individuals was necessary to prevent any single individual's identified pathological conditions from dominating the sample population (Wood et al. 1992, 345; DeWitte and Stojanowski 2015, 402). Time constraints prevented the analysis of the entire population. However, conducting analyses of a sample population compared to an overall population, even when possible, is considered more beneficial in anthropological research due to a decreased likelihood of errors (Thomas 1986, 35; Bernard 2011, 113).

The UI-SC is comprised of adult individuals, and consequently, no juveniles were analyzed in this study. For many of the individuals in the sample, medical professionals at Stanford University recorded biological sex and age at death. As age was not a factor of analysis in this study, individuals without recorded age were identified only as adults; no further investigation was taken to determine more precise age estimation. Because sex was analyzed in this study, though, individuals who did not have their biological sex identified were analyzed osteologically. Despite being incorporated into anthropological theory for decades, osteology has not taken gender into account until recently and it is therefore generally not included in osteological or bioarchaeological analyses; this study did not take individual gender preference into account. Individual sex has generally been defined as "the biological state of being male, female or intersex, as indicated by sex chromosomes, gonads, internal reproductive organs, and external genitalia, amongst other features," such as sexually dimorphic physical traits (Zuckerman and Crandall 2019, 162). In other words, human males and females tend to have sex-based physical distinctions in size and appearance of traits – especially regarding cranial and pelvic features. Individuals in this sample were sexed using the standard osteological methodology used by the Minnesota State University Osteological Laboratory, which emphasizes sexually dimorphic traits such as the size of mastoid processes, supraorbital ridges, and the sciatic notch (Bass 1987). Lastly, individuals' ancestry and country of origin were recorded when that information was available.

Pathological Inquiry

To provide the most accurate reconstruction of health possible, multiple pathologies were analyzed in the 144 individuals that comprise this sample. This was done to address the osteological paradox. Again, because individual cases provide minimal information, only comparative studies based on multiple pathologies can begin to reconstruct the health of past populations (Wood et al. 1992, 345; DeWitte and Stojanowski 2015, 402).

Social scientists, including osteologists and bioarchaeologists, are somewhat limited to which pathologies can be analyzed because most diseases leave no trace on skeletal remains (White and Folkens 2005, 317). Based on these limitations, researchers tend to select from a set of accessible and well-documented pathologies, frequently including the following examples.

> Although researchers often highlight specific diseases (scurvy, rickets, tuberculosis) when encountered, the vast majority of paleoepidemiological research focuses on more general, nonspecific, and macroscopic indicators of stress and presumed poor health. These indicators include enamel hypoplasias as markers of early childhood stress; oral health disorders; periosteal reactions as signatures of bone infections or trauma; osteomyelitis as an indicator of infection with pyogenic bacteria; and cribra orbitalia and porotic hyperostosis reflecting bodily response to anemia. (De Witte and Stojanowski 2015, 402; also see Ortner and Putschar 1981; Cook 1984; Goodman et al. 1984a; Goodman et al. 1984b; Wood et al. 1992; Driscoll and Weaver 2000, 158; Gold 2000, 211-213; Lambert 2000; Larsen and Sering 2000; Powell 2000, 19-20; Reeves 2000, 85; Steckel et al. 2002; Buzon et al. 2005; White and Folkens 2005; Zuckerman and Crandall 2019)

These pathologies do not account for the entirety of paleoepidemiological research, but they are the most frequently cited pathological conditions in the osteological and bioarchaeological literature. As such, based upon these examples of previous research and the historical context of San Francisco during the late nineteenth and early twentieth centuries, the pathologies analyzed in this study included tuberculosis, cribra orbitalia and porotic hyperostosis, periostitis and osteomyelitis, antemortem tooth loss, and linear enamel hypoplasia.

Tuberculosis

Tuberculosis is an infectious disease that can be regularly identified in human skeletal remains (De Witte and Stojanowski 2015, 402; Zucerkman and Crandall 2019, 167). It is a widely spread infectious disease that originates from the bacterium

Mycobacterium tuberculosis (Powell 2000, 19; White and Folkens 2005, 318). When spread, the infection is usually introduced to its host through the respiratory system. If the infection is left untreated for a significant period, tuberculosis can spread to other parts of the body through the bloodstream. This is more likely to occur in individuals that already have lowered immune responses due to malnutrition, other diseases, or pre-existing trauma (Ortner and Putschar 1981, 141; Powell 2000, 19). Tuberculosis is skeletalized, meaning the infection leaves pathological lesions on the bones, in about three percent of total cases (Ortner and Putschar 1981, 142; Powell 2000, 20). When tuberculosis enters the bloodstream, it is more likely to impact skeletal areas that have significant levels of hemopoietic (red) marrow; in these areas, the infection eats away the bone and leaves behind small, circular cavities known as tubercles (Ortner and Putschar 1981, 144-145; Powell 2000, 19). Vertebrae are the most likely area of the body to display evidence of tuberculosis, although the surface area of joints and the pelvis can also depict evidence of tuberculosis (Ortner and Putschar 1981, 145; Powell 2000, 19; White and Folkens 2005, 318). Therefore, due to temporal constraints, this thesis limited its analysis of tuberculosis in the remains of individuals from the turn of the twentieth century San Francisco strictly to vertebrae. Tuberculosis was recorded as either present or absent; if present, then it was determined whether the lesions displayed any evidence of healing. Frequencies of occurrence related to sex, immigration status, and ancestry were compared.

Tuberculosis was relatively widespread in San Francisco in the late nineteenth and early twentieth centuries. For instance, the California State Board of Health reported that tuberculosis was responsible for 16% of all recorded deaths in the state between 1870 and 1871, and 14.7% of all recorded deaths from June 30 to December 21, 1884 (California State Board of Health 1871, 55; California State Board of Health 1886, 62). The high prevalence of tuberculosis in California at this time was likely due to the state's appealing climate. During this period, medical professionals did not understand the infectious nature of tuberculosis and believed that fresh air and good climate were the best treatment options for individuals who exhibited signs of the infection, which resulted in the state advertising its climate to individuals infected with tuberculosis (Craddock 1998, 57-58).

Cribra Orbitalia and Porotic Hyperostosis

Cribra orbitalia and porotic hyperostosis are both pathological responses that are frequently found in skeletal remains that indicate the presence of iron-deficiency anemia, vitamin deficiency, defense against infection, or parasitic infection that ultimately caused nutritional deprivation in life (Cook 1984, 257; Goodman et al. 1984b, 29; Keenleyside 1998, 55; Lambert 2000, 179; Larsen and Sering 2000, 128; Steckel et al. 2002, 146; White and Folkens 2005, 320; De Witte and Stojanowski 2015, 425; Zuckerman and Crandall 2019, 165). Each of these possible causes of the two pathological responses depreciates the body's ability to function properly. Overall, cribra orbitalia and porotic hyperostosis place the impacted individuals at no elevated risk of death, but instead indicate diminished access to proper nutritious resources and medical intervention (Wood et al. 1992, 353).

The two pathologies can be distinguished based upon the observed location in the skull: cribra orbitalia lesions manifest on the superior, or upper, portion of the eye orbits as small bony growths, while porotic hyperostosis lesions appear on the frontal, parietal, and occipital bones of the cranium – in other words, on top of the skull or the cranial vault – typically in the form of pits or dimples (Goodman et al. 1984a, 289; Goodman et al. 1984b, 29; Larsen and Sering 2000, 121-122). These lesions demonstrate the body's attempt to create more red blood cells to combat the cause of nutritional deprivation. More often than not, juveniles are more likely to exhibit evidence of both cribra orbitalia and porotic hyperostosis. For instance, juveniles were more likely to be impacted than adults in archaeological samples from prehistoric North Carolina, Virginia, and the lower Illinois Valley region (Cook 1984, 257; Lambert 2000, 180). Adults depicting cribra orbitalia or porotic hyperostosis tend to show evidence of healing or bone remodeling (Larsen and Sering 2000, 122). In this study, cribra orbitalia and porotic hyperostosis will be analyzed by examining the upper eye orbits and the cranial vault respectively; pathological lesions were scored on a scale of healed, slight, moderate, and severe. Frequencies of occurrence related to sex, immigration status, and ancestry were compared. Lastly, since the individuals in this sample were adults, it will be expected that most, if any, cases of cribra orbitalia and porotic hyperostosis will be either healed or slight.

Periostitis and Osteomyelitis

Both periostitis and osteomyelitis are the result of skeletal lesions with infectious origins and occur most frequently on the long bones, especially the tibia (Ortner and

Putschar 1981, 132; Gold 2000, 213; Steckel et al. 2002, 146). Specifically, "periostitis is a condition of inflammation of the periosteum," which is the outer membrane that surrounds all living bones and is caused by trauma or infection without medical intervention (White and Folkens 2005, 318; also see Goodman et al. 1984b, 33; Gold 2000, 213). Periostitis generally impacts the outer surface of the bone and is identified by raised elevations on the external surface. The lesions appear as plaque-like deposits that are raised in irregular elevations due to periosteal inflammation on the bone surface (Ortner and Putschar 1981, 129-130; Steckel et al. 2002, 146). Osteomyelitis is the result of the bone dying, also known as necrosis, due to trauma and infection and, unlike periostitis, impacts the internal function of the bone (Goodman et al. 1984b, 33; White and Folkens 2005, 318). These pathologies are more likely to appear on long bones because the periosteum is less protected by muscle compared to other portions of the body (Ortner and Putschar 1981, 131).

Again, like cribra orbitalia and porotic hyperostosis, periostitis and osteomyelitis are not necessarily diseases but a response of the bone due to infection or trauma. They can be found "in every archaeological horizon and geographic location" in the New and Old World (Goodman et al. 1984b, 33; also see Ortner and Putschar 1981, 131; Cook 1984, 259). Because these pathologies are so widespread, they are likely to be present in individuals in the UI-SC collection. And, furthermore, because these pathologies tend to persist because of lack of medical intervention, they are likely to be more prevalent in populations that have less access to resources. In this study, analysis of periostitis and osteomyelitis were confined to the tibia because it had the highest likelihood to be impacted. If present, pathological lesions were scored on a scale of healed, slight, moderate, and severe. Frequencies of occurrence related to sex, immigration status, and ancestry were compared.

Antemortem Tooth Loss

Antemortem tooth loss refers to the loss of teeth before death. If teeth were lost before death, the alveolar bone (meaning the sockets holding the teeth that are present in both the mandible and maxilla, or the upper and lower jaws) will exhibit healing; healing is identified as the resorption, or smoothing, of the bone (Keenleyside 1998, 55; Lopez et al. 2012, 26-27; Trombley et al. 2019, 257). This is differentiated from teeth lost after death. In those cases, the alveolar bone would not exhibit any evidence of remodeling or healing.

Since antemortem tooth loss is so widely prevalent in both populations in the past and present, it is frequently used as an indicator of oral health in both osteology and bioarchaeology (Cook 1984, 258; Lopez et al. 2012, 26-27; Zuckerman and Crandall 2019, 168). Antemortem tooth loss can be caused by a variety of factors. In some cases, tooth loss in life, such as symbolic tooth extractions, is a cultural occurrence and therefore is not indicative of oral health. In other instances, however, antemortem tooth loss can be caused by significant tooth wear, trauma, nutritional deficiencies, caries (cavities) or other indicators of dental disease (Lukas 2007, 158; Lopez et al. 2012, 26-27; Trombley et al. 2019, 257). Individuals without access to dental health care are more likely to exhibit antemortem tooth loss. In this study, antemortem tooth loss was considered present when a tooth was not present and the alveolus depicted evidence of healing. The number of identifiable teeth lost antemortem was compared to the total number of teeth observable per individual, therefore this study identifies the minimal number of possible teeth lost antemortem in this sample (Liebe-Harkort 2012, 170; Trombley et al. 2019, 261). Frequencies of occurrence related to sex, immigration status, and ancestry were compared.

Linear Enamel Hypoplasia

Linear enamel hypoplasia has been frequently used to identify the health of populations in the past (Cook 1984, 255; Goodman et al. 1984b, 25). Linear enamel hypoplasia is a pathological condition that can be viewed macroscopically, or with the naked eye, on the external surface of the teeth that indicate nonspecific stress occurred during childhood when the permanent teeth were formed. The pathology "appears as a visible line or pit in the enamel of the tooth [that] formed during a slowing or cessation of normal enamel deposition during tooth formation. The slowing or cessation is due to a severe episode of stress typically caused by illness or lack of proper nutrition," (Driscoll and Weaver 2000, 158; also see Goodman et al. 1984b, 25; Lambert 2000, 184; Gold 2000, 211; Reeves 2000, 85; Amoroso et al. 2014, 463; Zuckerman and Crandall 2019, 162). Once the episode of stress, typically malnutrition, ceases, normal tooth development resumes. In some cases, multiple lines can be present on the teeth, which indicate multiple disruptions occurred during development. Anterior teeth, including incisors and canines, are more likely to depict linear enamel hypoplasia than premolars and molars (Driscoll and Weaver 2000, 158; Reeves 2000, 85). Since enamel is not resorbed or remodeled in life in the same way that bones are, linear enamel hypoplasia “provides a permanent and unaltered chronological memory of stress during [an individual’s] development,” (Goodman et al. 1984b, 25).

As previously mentioned, linear enamel hypoplasia is a pathology that occurs during childhood when permanent teeth are developing. Immigrants to San Francisco during the late nineteenth and early twentieth century who exhibited evidence of linear enamel hypoplasia experienced disruptions to their development during their childhood – which likely took place outside of the United States. This data was still collected because of several factors. Individuals who exhibit linear enamel hypoplasia were exposed to stress during their childhood; this might indicate that their health was already compromised at an early age, leaving them more susceptible to illness later in life. However, the contrary may also be true – adult individuals with linear enamel hypoplasia were obviously strong enough to survive either a single or multiple periods of stress during their childhood. In this case, linear enamel hypoplasia would be an indicator of good health.

In this thesis, linear enamel hypoplasia was identified as either present or absent. Scores were assigned based upon the following system: “0 = no observation possible; 1 = no hypoplasias present; 2 = one hypoplasia present; 3 = two or more hypoplasias present,” (Buzeon et al. 2005, 4; see also Amoroso et al. 2014, 463). Frequencies of occurrence related to sex, immigration status, and ancestry were compared.

Statistical Analysis

Analyses were conducted using simple statistical analysis, including establishing percentages of frequency for the observed populations in the sample, chi-square tests, and ANOVA, or analysis of variance, tests. In pathologies where only a few cases were present in the sample, chi-square tests were not conducted because not enough data were available. Chi-square statistical tests are frequently used in anthropology to establish whether or not a significant relationship existed between two selected variables (Thomas 1986, 284). In other instances, ANOVA tests were used to determine whether statistically significant differences were present in variable averages (Bernard 2011, 495). Variables analyzed included sex (male and female) and immigration status (immigrants versus American-born citizens).

CHAPTER FOUR: Results

In this study, 144 individuals were analyzed from the University of Iowa Stanford Collection (UI-SC) for a variety of pathologies that provided insight into the health of the inhabitants of San Francisco at the turn of the twentieth century. The sample was comprised of 114 male individuals and 30 female individuals. These people came from a variety of global regions, including the British Isles, Canada, Central America, Central Europe, Eastern Asia, Mexico, Northern Europe, Russia, Southern Europe, the United States, Western Europe, and regions unknown (see table 4.1 for a representation of the sample's sex and region of origin). In all, 59 individuals were immigrants to the United States while 49 individuals were born in the United States; the remaining 36 individuals did not have their country of origin documented in the UI-SC's records. Lastly, because these individuals were used as medical cadavers at the University of Stanford in the early-to-mid twentieth century, their remains were highly fragmented and specific bones were not always present. Therefore, some pathologies were not observable in certain individuals and, subsequently, frequencies and analyses were based on individuals where the pathology was observable.

Global Region of Origin	Male	Female	Total
British Isles	9	3	12
Canada	2	1	3
Central America	1	0	1
Central Europe	2	0	2
Eastern Asia	9	0	9
Mexico	3	0	3
Northern Europe	8	0	8
Russia	1	0	1

Southern Europe	8	0	8
United States	37	12	49
Western Europe	11	1	12
Unknown Region	23	13	36
Total	114	30	144

Table 4.1. Demographic breakdown of UI-SC sample.

Tuberculosis

Tuberculosis is an infectious disease that affects the respiratory system. When left untreated, the bacteria can spread to the rest of the body; in about 3% of individuals, tuberculosis manifests in the skeleton in specific areas (Ortner and Putschar 1981, 141; Powell 2000, 19). One of the most frequently impacted areas includes the spine and individual vertebrae. Therefore, the analysis of tuberculosis was confined to vertebrae because this portion of the body has the highest chance of demonstrating evidence of this infection.

In the UI-SC sample, only 36 out of 144 individuals had any vertebrae present. In those 36 individuals, none of them exhibited evidence of tuberculosis. No further statistical analysis was conducted.

Cribra Orbitalia and Porotic Hyperostosis

Cribra orbitalia and porotic hyperostosis are both pathological responses in the bone that are caused by a variety of factors that indicate nutritional deprivation in life (Cook 1984, 257; Goodman et al. 1984b, 29; Keenleyside 1998, 55; Lambert 2000, 179; Larsen and Sering 2000, 128; Steckel et al. 2002, 146; White and Folkens 2005, 320; De Witte and Stojanowski 2015, 425; Zuckerman and Crandall 2019, 165). Both pathologies generally impact juveniles, and therefore, any instances in this study would demonstrate evidence of healing.

Specifically, cribra orbitalia is identified as a pathological growth response in the bone that, when present, is located on the upper eye orbit. Only 24 individuals in the UI-SC sample had either a single or both eye orbits preserved. No cases of cribra orbitalia were identified and, consequently, no further statistical analysis was conducted.

Porotic hyperostosis is a pathological response of the bone that demonstrates bone reabsorption compared to bone growth, as in the case of cribra orbitalia, in response to environmental pressures. Porotic hyperostosis is typically identified as lesions that appear as pits or dimples located on the frontal, parietal, and occipital bones of the skull (Goodman et al. 1984a, 289; Goodman et al. 1984b, 29; Larsen and Sering 2000, 121-122).

In the UI-SC sample, 128 individuals had their cranial vault (or skull cap) included with their remains. There were a total of three possible cases of porotic hyperostosis. The first case was in a male (ID: 9a) of unknown ancestral origins. His small, pit-like lesions on his posterior parietals and superior occipital bones are most likely evidence of a healed minor case of porotic hyperostosis (See image

Image 4.1. Possible case of healed porotic hyperostosis in individual 9a.

4.1). The second possible case was observed in a female (ID: 71) of unknown ancestral origins. She had very slight pit-like lesions on her cranial vault that could indicate healed porotic hyperostosis or evidence of an unidentified infection. Lastly, the third possible case was identified in a male (ID: 853) born in the United States. He had some small pinprick-sized lesions on his parietal bones. This could be evidence of healed porotic hyperostosis or natural biological processes related to the closure of the sagittal suture. Ultimately, because only three individuals had possible evidence of porotic hyperostosis, no further statistical analysis was conducted.

Periostitis and Osteomyelitis

Both periostitis and osteomyelitis are bone growth responses that are the result of skeletal lesions with infectious or traumatic origins. These occur most frequently on the long bones, especially in the tibia due to its lack of protection from surrounding muscles compared to other bones (Ortner and Putschar 1981, 132; Gold 2000, 213; Steckel et al. 2002, 146).

Periostitis is the inflammation of the periosteum, or the outer protective membrane that surrounds all bones in life, which is caused by trauma or

Image 4.2. Active periosteal reaction in individual 79a.

infection (Goodman et al. 1984b, 33; Gold 2000, 213; White and Folkens 2005, 318). The bone reacts with the periosteum and causes raised areas of bone to appear on the surface. In the UI-SC sample, 137 individuals had one or both tibiae present, and four of these individuals within the observable sample had evidence of periostitis.

Image 4.3. Severe case of periostitis in individual 988.

The first recorded instance was in a female (ID: 79a) of unknown ancestral origin. Her right tibia showed an active periosteal reaction that may have been beginning to heal (see image 4.2). The second individual was a male (ID: 881) from the United States. His right tibia showed evidence of a minor periosteal reaction. The third individual was also a male (ID: 918) from the United States. His left tibia showed evidence of a healed infection. Lastly, a female (ID: 988) of unknown ancestral origin had a left tibia that evinced two cases of periostitis. She had a severe case of partially healed periostitis on both the medial distal end and lateral mid-shaft of her left tibia, and a severe active case at the medial distal end and lateral distal shaft of her right tibia (see image 4.3). As only four individuals in the UI-SC sample had evidence of periostitis, no further statistical analysis was conducted.

Osteomyelitis, like periostitis, is a severe infection in the bone due to trauma or infection. Osteomyelitis, however, occurs when the inner portion of the bone dies, generally causing large lesions to appear in the surface of the bones (Goodman et al. 1984b, 33; White and Folkens 2005, 318). In this study, the tibia was solely observed for osteomyelitis because of the high instances in which osteomyelitis occurs in this particular area. In the UI-SC sample, 137 individuals had one or both tibia present. No cases of osteomyelitis were observed, and subsequently, no further statistical analysis was conducted.

Antemortem Tooth Loss

Antemortem tooth loss refers to the loss of teeth before death and is identified when the alveolar bone, or tooth sockets, exhibits healing (Keenleyside 1998, 55; Lopez et al. 2012, 26-27; Trombley et al. 2019, 257). Antemortem tooth loss was observable in 82 individuals in the UI-SC sample. Out of the 82 observable individuals, 78 demonstrated evidence of antemortem tooth loss. This means that only four people (4.9%) in this sample of the UI-SC collection showed no evidence of tooth loss before death. Antemortem tooth loss ratios were calculated dividing the total number of teeth lost by the total number of teeth observable for each individual.

Because such a high percentage of the sample showed evidence of antemortem tooth loss, further statistical analysis was conducted to determine whether or not there were significant relationships between average antemortem tooth loss ratios with sex and immigration status. There was not enough data to analyze differences in antemortem tooth loss between global regions of origin.

Analysis 1: Sex

In this sample, 78 people had evidence of some form of tooth loss before death. Of these 78 individuals, 12 were identified as females, all of which experienced some form of tooth loss before death. Four females were completely edentulous, meaning that they had lost all of their observable teeth before death. The remaining 66 individuals in the observable sample were identified as males, with 22 male individuals being edentulous. Individuals without any evidence of tooth loss before death were identified as male.

In this analysis, an ANOVA statistical test was used to compare the average difference between antemortem tooth loss ratios between individuals identified as male compared to female. The null hypothesis stated that there was no significant difference between the average ratio of antemortem tooth loss between males and females, while the hypothesis stated that there would be a significant difference. The average antemortem tooth loss ratio for males was 0.6374. The average antemortem tooth loss ratio for females was 0.6551. After running the ANOVA test, the resulting significance value was 0.875. In social and behavioral sciences, the standard threshold for significance argues the significance value must be under 0.05. Therefore, the null hypothesis was not rejected, meaning that in this sample, there was no significant difference between the average antemortem tooth loss ratio between males and females. Results form the ANOVA test can be observed in Image 4.4.

Between-Subjects Factors

		N
Gender	1	12
	2	66

1=Female
2=Male

Descriptive Statistics

Dependent Variable: AMTL Ratio

Gender	Mean	Std. Deviation	N
1	.65510833	.359632268	12
2	.63742879	.356469747	66
Total	.64014872	.354662031	78

All "NA" cases had to be excluded

Tests of Between-Subjects Effects

Dependent Variable: AMTL Ratio

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	.003[a]	1	.003	.025	.875	.000
Intercept	16.964	1	16.964	133.153	.000	.637
Gender	.003	1	.003	.025	.875	.000
Error	9.682	76	.127			
Total	41.649	78				
Corrected Total	9.685	77				

a. R Squared = .000 (Adjusted R Squared = -.013)

Image 4.4. ANOVA test results for antemortem tooth loss ratio comparison between males and females.

Analysis 2: Immigration Status

In this sample, there were 26 individuals who were immigrants to the United States and 24 individuals who were born in the United States that could be analyzed for antemortem tooth loss. Out of the all the individuals who immigrated to the United States, 8 individuals were edentulous and only one individual had no evidence of antemortem tooth loss. Likewise, 7 individuals born in the United States were edentulous and one person had no evidence of antemortem tooth loss. Individuals without data indicating if they were immigrants to the United States were not included in this analysis.

In this analysis, an ANOVA test was used to compare the average difference between antemortem tooth loss ratios between individuals who immigrated to the United States and individuals who were born in the United States. The null hypothesis stated that there was no significant difference between the average ratio of antemortem tooth loss regarding immigration status, while the hypothesis stated that there would be a significant difference. The average antemortem tooth loss ratio for immigrants was 0.6028. The average antemortem tooth loss ratio for individuals born in the United States was 0.2113. After running the ANOVA test, the resulting significance value was 0.268. As previously stated, in social and behavioral sciences, the standard threshold for significance argues the value must be under 0.05. Therefore, the null hypothesis was not rejected, meaning that in this sample, there was no significant difference between the average antemortem tooth loss ratio between immigrants and individuals who were born in the United States. Results form the ANOVA test can be observed in Image 4.5.

Between-Subjects Factors

		N
Immigrant to US	N	24
	Y	26

Tests of Between-Subjects Effects

Dependent Variable: AMTL Ratio

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.147[a]	1	.147	1.254	.268
Intercept	21.555	1	21.555	183.852	.000
ImmigranttoUS	.147	1	.147	1.254	.268
Error	5.628	48	.117		
Total	27.222	50			
Corrected Total	5.775	49			

a. R Squared = .025 (Adjusted R Squared = .005)

Image 4.5. ANOVA test results for antemortem tooth loss ratio comparison between immigrants and American citizens.

Linear Enamel Hypoplasia

Linear enamel hypoplasia (LEH) is the pathological occurrence of lines appearing in permanent or adult teeth due to significant developmental disruptions in childhood, possibly due to famine (Goodman et al. 1984b, 25; Driscoll and Weaver 2000, 158; Lambert 2000, 184; Gold 2000, 211; Reeves 2000, 85; Amoroso et al. 2014, 463; Zuckerman and Crandall 2019, 162). In the UI-SC sample, 60 individuals had at least one tooth that could be analyzed for the presence of LEH. In all, 17 individuals had at least one observable instance of LEH. Male individuals had 13 instances of LEH, including 5 immigrants, 2 individuals born in the United States, and 6 males of unknown ancestral origin. Female individuals had 4 instances of LEH, including 2 individuals born in the

United States and 2 individuals of unknown ancestral origins. Overall, individuals in the UI-SC sample were assigned a score based upon the following system: 0 (not observable), 1 (not present), 2 (1 case), or 3 (2+ cases). This information can be viewed in Table 4.2. As numerous cases of LEH were identified, further statistical analysis was conducted using chi-square tests to determine whether significant relationships existed between the presence of LEH and additional variables including sex and immigration status. Global region of origin could not be analyzed due to small sample sizes in certain regions.

Score 0	Score 1	Score 2	Score 3
84	43	3	14

Table 4.2. LEH scores in the UI-SC sample.

Analysis 1: Sex

In the first analysis of LEH data, chi-square tests were used to determine whether significant statistical relationships existed between the presence of LEH and sex in turn of the twentieth century San Francisco. The hypothesis for this test stated: there are sex-based differences in the frequency of LEH in the UI-SC sample. The null hypothesis (H_0) therefore assumed that no sex-based differences existed in the frequency of LEH in the UI-SC sample. The difference between the observed variables based on score and sex can be observed in Table 4.3, while the expected values, which are determined through probability, can be observed in Table 4.4. The chi-square test to determine whether or not a significant relationship existed between sex and the presence of linear enamel hypoplasia resulted in a p-value of 0.4692; again, in social and behavioral sciences, the standard threshold for significance argues the p-value must be under 0.05 to reject the null hypothesis. Therefore, the null hypothesis was not rejected. This means that in this sample, there were no sex-based differences in the frequency of linear enamel hypoplasia between male and female individuals.

Score	**0**	**1**	**2**	**3**	**Total**
Male	65	36	4	9	114
Female	19	7	0	4	30
Total	84	43	4	13	144

Table 4.3. Observed LEH scores in males/females in the UI-SC sample.

Score	**0**	**1**	**2**	**3**	**Total**
Male	66.5	34.04	3.17	10.29	114
Female	17.5	8.96	0.83	2.71	30
Total	84	43	4	13	144

Table 4.4. Expected values based on probability of LEH scores in males/females in the UI-SC sample.

Analysis 2: Immigration Status

In the final analysis of LEH data, a chi-square test was also used to determine whether significant statistical relationships existed between the presence of LEH and an individual's immigration status. Individuals without known region of origin were not included in this analysis. The difference between the observed variables based on score and immigration status can be observed in Table 4.5, while the expected values, which are determined through probability, can be observed in Table 4.6. The hypothesis for this test stated: There are immigration status-based differences in the frequency of LEH in the UI-SC. The null hypothesis (H_0) therefore assumed that there are no immigration status-based differences in the frequency of LEH in the UI-SC. The chi-square test to determine whether or not a significant relationship existed between immigration status and the presence of LEH resulted in a p-value of 0.8239. Because this value is above the threshold of 0.05, the null hypothesis was not rejected. Therefore, there were no differences in the frequency of linear enamel hypoplasia between immigrants or individuals born in the United States.

Score	**0**	**1**	**2**	**3**	**Total**
Immigrant	38	16	1	4	59
American	32	13	2	2	49
Total	70	28	3	6	108

Table 4.5. Observed LEH scores in immigrants/Americans in the UI-SC sample.

Score	**0**	**1**	**2**	**3**	**Total**
Immigrant	38.24	15.84	1.64	3.28	59
American	31.76	13.16	1.36	2.72	49
Total	70	28	3	6	108

Table 4.6. Expected values based on probability of LEH scores in immigrants/Americans in the UI-SC sample.

CHAPTER FIVE: Discussion

In this thesis, a sample of a very diverse group of individuals from the University of Iowa Stanford Collection (UI-SC) was analyzed for differences in overall health through a variety of skeletal indicators. The 144 adult individuals in this sample were born in a variety of global regions, including the British Isles, Canada, Central America, Central Europe, Eastern Asia, Mexico, Northern Europe, Russia, Southern Europe, the United States, Western Europe, and regions unknown. Despite coming from a wide variety of geographical locations, these individuals died in San Francisco in the early to mid-twentieth century. However, certain regions made up a higher percentage of this sample than others. For instance, 37, or 25.7%, individuals were born in the United States, while 38, or 26.4%, individuals in this sample were born in Europe. Only 10 individuals, or 7% of the sample, were born in countries of Asia. Approximately four percent of the sample, or 6 individuals, was born in other North American regions besides the United States, including Canada, Mexico, and Central America. Lastly, 23 individuals comprising 16% of the population did not have their country of origin identified in their death records.

The data from the sample matches with demographic information from California during the early twentieth century. Although Chinese immigrants and other immigrants from Asia made up a large segment of the San Franciscan population throughout the middle nineteenth century, this population decreased significantly after the passage of numerous immigration restriction acts beginning in the 1880s (Craddock 1990; Pamuk

2004, 292; Wang 2008, 30). This led to European immigrants and their descendant populations to comprise a higher percentage of San Francisco's overall population by the turn of the twentieth century. By 1900, about 90% of California's population was identified as white (Yamato 1994, 37; Cherny et al. 2011, xv). These population demographics are reflected in the small sample of 144 individuals included in this thesis.

The sample in this thesis is comprised of significantly more individuals identified as male than female. Individuals identified as male were present in every identified global region. However, individuals identified as female only came from the British Isles (3), Canada (1), Western Europe (1), and the United States (12). There were 13 females without any regional affiliation recorded. The lack of female individuals from Asian countries is likely because most Asian immigrants were male, who often came to the United States in search of labor work but frequently had the intention of returning to their countries of origin after earning a living.

The significant difference between the number of male and female individuals in this sample might also be due to San Francisco's gender ratio in its early history. In the mid-to-late nineteenth century, San Francisco and the surrounding area had a higher male than female population due to the gold rush and jobs related to the railroads. Similarly, males were recorded as dying at nearly twice the rate as females in San Francisco in the mid-to-late nineteenth century (California Board of Health 1871, 58). However, the population discrepancies between males and females leveled out in the twentieth century after other industries moved into the area as well, encouraging the growth of families. Lastly, the difference between males and females in this sample may more likely be due to the overall UI-SC comprising of more male individuals, which is common for osteological collections of disenfranchised individuals (Buzon et al. 2005, 4). Consequently, the individuals selected for the sample were to be predominately male as well.

Finally, in life, these individuals likely shared a low socioeconomic status because of their inclusion in the UI-SC. According to the UI-SC, the individuals in this collection were used as medical cadavers after death at Stanford University in California because they were “either too impoverished to afford a funeral or had no family to claim them.” Again, because these individuals were used as medical cadavers, this indicates these individuals had low socioeconomic status in life because marginalized groups generally had little agency or means to decide what happened to their remains in death (Nystrom 2011, 169). Because they all shared similar economic status, these individuals could therefore be tested for variation in health status based upon sex and immigration status.

Tuberculosis

Tuberculosis is an infection to the respiratory system that, in severe cases, is observable in skeletal remains. In this sample, no individuals demonstrated evidence for skeletonized tuberculosis in their vertebrae. This is certainly not surprising given that tuberculosis only appears in the skeletal remains of approximately three percent of infected individuals (Ortner and Putschar 1981, 141; Powell 2000, 19). Tuberculosis only leaves physical traces in the skeleton when the infection is left untreated for a significant amount of time, allowing the infection to spread throughout the body via the bloodstream and create circular cavities in hemopoietic, or red, marrow producing bones (Ortner and Putschar 1981, 141, 144-145; Powell 2000, 19-20). Again, this only occurs in the most severe cases. Therefore, individuals in this sample did not have severe cases of tuberculosis.

Nonetheless, this does not mean that the individuals in this sample did not have minor cases of tuberculosis at some point in their lives. To begin with, only 36 out of the 144 individuals in the sample had vertebrae present, which distinctly limited the number of individuals for which evidence of tuberculosis was observable. If time and financial constraints had not been a factor in this thesis, additional skeletal areas besides the vertebrae could have been observed for traces of tuberculosis, including the pelvis, ribs, and joint surfaces. Additionally, as previously mentioned, skeletal evidence of tuberculosis is rare – it only manifests in approximately 3% of cases. Consequently, these individuals could have had tuberculosis, even severe cases of it, but the disease could have progressed rapidly without leaving any skeletal evidence behind.

It is also highly likely that some individuals in this sample were exposed to tuberculosis at one point in their lives because of the high prevalence rate in San Francisco and the surrounding area in this period. In the 1880s, tuberculosis, also known as consumption, was responsible for nearly fifteen percent of all deaths in the second half of 1884 (California State Board of Health 1884, 62). Furthermore, there is evidence that tuberculosis continued to be a burden on the state of California in the early twentieth century. In 1916, the California State Board of Health released a primer for school children about the dangers of tuberculosis and what they, the children, could do to stop the spread in their communities. State officials were concerned because tuberculosis continued to cause “more than five thousand persons in [the] state to die every year, including several hundred children,” (California State Board of Health 1916, 7). Because the individuals in this sample were generally of low socioeconomic status, and therefore more likely to live in crowded quarters of the city, they were likely in contact with the disease even if it did not manifest physically in their skeletal remains.

As no individuals in the sample demonstrated direct evidence of tuberculosis, no further statistical analysis was conducted to examine differences between sex or immigration status.

Cribra Orbitalia and Porotic Hyperostosis

Both cribra orbitalia and porotic hyperostosis are physical responses of the bone caused by nutritional deprivation, including anemia, or infection that tend to manifest more frequently, although not always, in juveniles. Since the individuals in this sample were adults, it was expected that most, if any, cases of cribra orbitalia and porotic hyperostosis would be either healed or slight. This means that in individuals who were immigrants to the United, this pathology indicated lower quality of health earlier in life – most likely before they arrived. Yet if immigrants depicted active evidence of either pathology, this could indicate those individuals had potentially diminished health as adults due to persistent illness. On the contrary, however, healed evidence of either pathology could indicate an individuals’ robustness – meaning that they were strong enough to survive their affliction.

In this sample, no individuals were found to have evidence of cribra orbitalia in their upper eye orbits. Out of the 144 individuals analyzed, only 24 had one or both eye orbits preserved. Although the superior border of the eye orbit was frequently preserved for individuals, the upper eye orbit itself was repeatedly missing. This prevented the observation of cribra orbitalia for 83% of the sample. As in the case of tuberculosis, missing remains severely limited the number of individuals in this study that could be examined for cribra orbitalia and, consequently, no further analysis was conducted.

Porotic hyperostosis was observable in considerably more individuals in this sample. In all, 128 individuals had the top portion of their skull, or cranial vault, included with their remains. As these individuals were used as medical cadavers at Stanford University, most of the cranial vaults were separated from the skull through autopsy cuts. Three of these individuals, or approximately two percent of the observable sample, had possible evidence of porotic hyperostosis – two of these individuals were male, one of whom was from the United States while the other had no known region of origin, and the other individual was identified as female, also with unknown origins. However, these individuals might have had underlying conditions that were responsible for the pinpricks and dimpling that appeared on the three individuals' cranial vaults, including unidentified infections or bone response due to the obliteration of the sagittal suture, which frequently occurs in older individuals.

If these observed pathological lesions were porotic hyperostosis, the results from the UI-SC sample were comparable to the findings that Buzon et al. found in 2005 through analysis of the Golden Gate Cemetery, a late nineteenth century San Franciscan cemetery, which comprised of a similar population to the sample in this study. In the Golden Gate Cemetery analysis approximately three percent of their sample had evidence of porotic hyperostosis (Buzon et al. 2005, 6). All lesions showed evidence of remodeling, indicating that these individuals were impacted early in life. Likewise, the Golden Gate Cemetery study found that 8% of individuals in the sample had evidence of healed cribra orbitalia. However, both of these samples had considerably less evidence of porotic hyperostosis than was evident in the African Burial Ground Cemetery in New York City, which at one time may have been the final resting place of approximately 15,000 African Americans, including slaves, who lived during colonial America. In this sample, which comprised of 419 individuals, nearly 24% of children and 47.3 % of adults had evidence of porotic hyperostosis, indicating severe cases of anemia and nutritional deprivation in almost a quarter of the population (Blakey 2010, 66; Frohne 2015, 160).

Overall, no cases of cribra orbitalia and only three possible cases of porotic hyperostosis were present in this sample. This could potentially indicate improved access to resources in San Francisco by the early twentieth century compared to when the city was first established. In its early years, San Francisco's population rapidly expanded, causing nutritious food, such as vegetables and fruits, to be scarce (Buzon et al. 2005, 10). As the population stabilized into the twentieth century, individuals of lower socioeconomic status were more likely to have greater access to nutritious foods.

To more accurately compare health through cribra orbitalia and porotic hyperostosis between ethnically diverse immigrants and Western European-descended San Franciscans in the early twentieth century, juvenile remains of both groups should be compared in future studies. Second-generation immigrants may provide more equivalent results because they would have been born and raised in the United States, unlike their parents. Discrepancies in health could remain between second-generation immigrants and Western European-descended San Franciscans because racism and inequality persisted well into the twentieth century and most likely continued to have an impact on individual health.

Periostitis and Osteomyelitis

Periostitis and osteomyelitis are responses of bone due to infection or trauma, especially in the long bones. It was hypothesized that individuals in this sample would demonstrate examples of these pathological reactions because individuals of low socioeconomic status do not always have access to resources, including health care, which could prevent cases of both periostitis and osteomyelitis from developing. In this sample, 137 individuals had one or both tibiae present for analysis of periostitis and osteomyelitis.

In this sample, four individuals, two males (from the United States) and two females (of unknown ancestral origins), had evidence of periostitis located on their tibia, which amounts to approximately three percent of the observable population. Both females depicted evidence of severe active cases, meaning that the infection was present and ongoing near the end of their lives. The frequency of periostitis in this sample was significantly lower than the rate observed in the Golden Gate Cemetery's sample, where 20% of individuals had evidence of periostitis on at least one of their tibiae (Buzon et al.

2005, 6). The decrease in the frequency of periostitis in the UI-SC sample compared to the Golden Gate Cemetery's sample could indicate that medical care improved in San Francisco for the poorest members of the population between 1900 and the 1930s through the 1950s, which is when a majority of this sample died. Lastly, because there was not enough data, statistical comparisons between sex, ancestry, and immigration status could not be conducted.

Osteomyelitis is a more severe reaction of the bone due to infection or trauma than periostitis. In this sample, no individuals had evidence of osteomyelitis. Again, because osteomyelitis was not present in the sample, this could indicate health care was accessible for the individuals with the lowest status in early twentieth century San Franciscan society.

Antemortem Tooth Loss

Antemortem tooth loss was present in 78 out of 82 observable individuals in this sample, meaning over 95% of individuals were missing teeth in life. This is a higher frequency than the Golden Gate Cemetery, where about 80% of individuals experienced antemortem tooth loss (Buzon et al. 2005, 8). This could be general variation, or it could attest to a decrease in health in the early twentieth century compared to individuals who died in the late nineteenth century. A decrease in oral health amongst San Francisco's lowest socioeconomic status individuals during the early twentieth century could have been caused by the Great Depression of the 1930s, which occurred near the end of most of the UI-SC individuals' lifetimes. The Great Depression caused severe economic hardship and would have severely limited these individuals' access to health care.

Mean ratios of antemortem tooth loss for the UI-SC sample, which were calculated by dividing the total number of teeth lost in life by the total number of observable teeth, were analyzed for significant differences between males/females and individuals who immigrated to the United States versus individuals who were born in the United States using ANOVA statistical analysis; because there were not enough individuals in each global region of origin, analysis based on ancestry was not conducted.

Analysis 1: Sex

In the UI-SC sample, all of the 12 observable females had evidence of antemortem tooth loss, with four of them being completely edentulous. For males, out of the 66 observable individuals, three exhibited no evidence of antemortem tooth loss and 22 were edentulous. This means that approximately 33% of males and 33% of females were edentulous. Edentulous individuals, meaning individuals who have lost all teeth in life, have poor oral health and are more likely to have poor overall health due to changes in food consumption, interpersonal communication, and self-esteem (Yamaga et al. 2018, 261; Samille Biasi et al. 2019, 634). Therefore, it can be determined that nearly a third of individuals in this sample experienced hardships and ill health due to their lack of teeth. When antemortem tooth loss ratios for male and female individuals were compared through ANOVA analysis, though, the differences were not statistically significant. This indicates that antemortem tooth loss impacted individuals regardless of sex. Overall, individuals in turn of the twentieth century San Francisco likely did not have sufficient access to dental health care.

Analysis 2: Immigration Status

In this sample, 82 individuals were observable for antemortem tooth loss. Out of those individuals, 26 immigrants to the United States and 24 individuals born in the United States had observable evidence of antemortem tooth loss. Individuals without known immigration status were not analyzed. Each group had one person identified as having no evidence of antemortem tooth loss, while 8 immigrants (30.8%) and 7 American citizens (29.2%) were edentulous. Therefore, both groups had a similar occurrence of having all teeth lost antemortem.

Furthermore, when antemortem tooth loss ratios between immigrants and American citizens were compared, no significant difference was identified. This indicates that despite differences in racially-ascribed status due to the social ideology of early twentieth century America, immigrants and American citizens, who were predominantly Western European-descended individuals, did not have differences in antemortem tooth loss frequencies. As in the case with sex, individuals in turn of the twentieth century San Francisco had, overall, poor dental health care – likely due to their shared low economic status.

Linear Enamel Hypoplasia

Linear enamel hypoplasia (LEH) is a pathology present in permanent teeth that signifies developmental disruptions, likely due to famine, in childhood. In the UI-SC sample, 60 individuals had at least one tooth present that could be evaluated for the presence of LEH. Upon analysis, 17 individuals, or 28.3% of the observable population, were found to have at least one instance of LEH. This is a lower frequency than what was observed in the Golden Gate Cemetery sample. Here, approximately 50% of observable individuals had evidence of LEH on their anterior teeth (Buzon et al. 2005, 4). Again, as was the case with porotic hyperostosis, this could indicate improved health during childhood for the lowest status inhabitants who were either born in or migrated to San Francisco around the turn of the twentieth century. However, the frequency of LEH in the UI-SC sample was also significantly lower than African American individuals from the African Burial Ground Cemetery in New York City. In this case, individuals had exceptionally high cases of LEH that amounted to 70.8% of the population (Frohne 2015, 154). This demonstrates the hardships and abuse experienced by members of the African Burial Ground in their lifetimes.

To make comparisons between individuals in this sample, each person was scored based upon the observable instances of LEH. Chi-square analyses were conducted to determine if significant differences occurred between individuals based on sex and immigration status.

Analysis 1: Sex

In the UI-SC sample, 17 individuals had confirmed instances of LEH present. Of these 17 individuals, 13 were identified as male and 4 were identified as female. When analyzed based on percentages of the observable population in this sample, LEH was present in 26.5% of males and 36.4% of females. Chi-square tests were applied to test if these differences were significant. The null hypothesis was not rejected in the analysis, meaning that there were no statistically significant differences in the frequency of LEH between male and female individuals.

As LEH indicates growth disruptions in childhood, the condiction is an early-life health indicator. The chi-square analysis indicates that for individuals in this sample, sex did not play a significant role in health during childhood. This is comparable to the Golden Gate Cemetery sample, where no statistically relevant differences between sex groups were found based on oral health either (Buzon et al. 2005, 4).

Analysis 2: Immigration Status

In this sample, 5 individuals who immigrated to the United States had evidence of LEH, compared to four individuals who were born in the United States. When analyzed based on percentages of the observable population, LEH was present in 23.8% of immigrants and 23.5% of Americans. Similar to the analysis of sex and LEH, chi-square tests were used to determine whether these frequencies were statistically significant. The null hypothesis was not rejected, indicating that there were no statistically significant differences between immigrants and individuals born in the United States regarding the incidence of LEH. Therefore, immigrants and American citizens in this sample had comparable instances of growth disruption in childhood.

Summary and General Observations

In this thesis, it was expected that individuals who were immigrants would have poorer general health than individuals who were born in the United States due to social and racial issues that were highly prevalent in San Francisco around the turn of the twentieth century. This was assessed through a variety of health indicators that have been well-established within the anthropological discipline, including tuberculosis, cribra orbitalia and porotic hyperostosis, periostitis and osteomyelitis, antemortem tooth loss, and linear enamel hypoplasia. No individuals in this sample had skeletal evidence of tuberculosis even though it was highly prevalent in the city around the turn of the twentieth century. Likewise, no individuals had evidence of cribra orbitalia, and only three individuals had evidence of porotic hyperostosis. Four individuals had evidence of periostitis, while no one in the sample had evidence of osteomyelitis. However, nearly every individual in the sample who had their maxilla and mandible present with their remains had evidence of antemortem tooth loss, and 17 individuals had evidence of linear enamel hypoplasia.

In this study, dental health indicators were the only variables that had enough observed instances to do further statistical analysis based on sex and immigration status. Due to the vast historical evidence of racial tensions in the United States and the San Francisco area around the turn of the twentieth century, it was expected that immigrants had poorer dental health than individuals born in the United States. The analysis of LEH indicated that, as children, both groups experienced similar instances of hardship, while the analysis of antemortem tooth loss showed that both groups did not have significant differences in adult dental health – which likely occurred in the San Francisco area. It was therefore concluded that everyone in this sample, regardless of sex or immigrations status, had poor oral health (again, over 95% of individuals in this study with their mandible or maxilla present had evidence of tooth loss before death) and likely had little access to oral health care. This conclusion supports their shared low economic status in life.

This concept of overall poor oral health from this time was supported by the study conducted by Steckel et al. in 2002 that attempted to document and analyze the history of health in the Western hemisphere through the analysis and comparison of archaeological and historic human remains of individuals of Native American, African, and European American ancestry. Regrettably, in Steckel et al.'s 2002 study, Asian American individuals were not included in this analysis. In this study, individuals of European American ancestry had the worst oral health out of any observed group. Besides little access to oral health care, the Steckel et al.'s 2002 study hypothesized that European Americans had the worst oral health due to "the emphasis on carbohydrates, including cheap and ready to access refined sugar, [that] contributed to poor dental conditions [in this group], as is typical of many other nineteenth century groups studied by anthropologists," (Steckel et al. 2002, 153). It is likely poor diet, in addition to little dental health care, contributed to the oral health and high instance of antemortem tooth loss in the UI-SC sample as well.

Despite the existing social issues, individuals in this sample appeared to have a similar quality of health regardless of immigration status or even sex as indicated by the rates of health indicators present. This could potentially indicate that economic status, even more so than racial status, impacted the health of individuals in turn of the twentieth century San Francisco. Furthermore, due to the comparisons made between the Golden

Gate Cemetery sample and the UI-SC sample, there is evidence that general health may have improved from the late nineteenth century to the early twentieth century as observed in decreased rates of porotic hyperostosis and periostitis.

This thesis, and the study of health through the examination of human remains in general, does have some limitations. To begin with, it would be difficult to compare these findings to affluent or upper-class members of San Franciscan society because most archaeological collections are comprised of disadvantaged individuals. There are very few instances, especially within historic America, where the remains of high-status individuals are accessible. However, a cemetery at medieval Trino Vercellese, Italy does show statistically significant differences in elite and lower-class individuals' health. In this case, lower-class males had worse health because their diets were comprised of higher amounts of millet and less animal protein than their elite counterparts (Reitsema and Vercellotti 2012, 597). Again, an analysis of the elite inhabitants of San Francisco around the turn of the twentieth century is not possible at this time, although the assumption is that this population, like that of Trino Vercellese and many other bioarchaeological studies (Weiss et al. 2013, 603; Yaussy 2019, 127), would have differences in overall health compared to their lower-class counterparts based on diet and the upper-class' luxury of avoiding the hardships associated with lower-class life.

Overall, the individuals in this sample lived most of their lives before the advent of antibiotics and other modern biomedical healthcare advancements. Everyone's health in the turn of the twentieth century San Francisco was impacted by exposure to disease regardless of his or her immigration status. Because modern health care was not available, many indicators of poor health were able to manifest biologically in physical remains – and this is seen even more frequently in those of lower socioeconomic status. Lastly, even though this thesis did not find specific evidence addressing racism, it is likely that racism, because of both its prevalence in the historical record and its capacity to impact so many facets of individuals' lives, had a significant impact on the social inequality of these largely forgotten inhabitants of San Francisco.

CHAPTER SIX: Conclusion

Between 1880 and 1920, the United States experienced dramatic changes to its cultural landscape as thousands of immigrants from Europe, Asia, and North America flowed into the country, particularly to San Francisco, which became one of the most diverse regions in the United States at this time. Historical evidence has demonstrated that new immigrants were regularly rejected by American citizens in the city, who themselves had been immigrants several generations ago, because they did not fit into America's established racialized social hierarchy and were often viewed as competition. This was often detrimental to new immigrants' success because position within the social hierarchy frequently shaped their ability to access necessary resources. Therefore, this thesis expected that immigrants would likely have worse health than their white, Western European-descended American counterparts due to the strains associated with racial discrimination.

To understand the health of San Francisco's inhabitants from the early twentieth century beyond historical evidence, osteological methodology was used in the analysis of the remains of 144 individuals in the University of Iowa Stanford Collection who had been both immigrants and Americans at the time of their death. Osteological methodology has been repeatedly used within bioarchaeology to understand the health of people in the past. However, because they were included in this collection, it is highly likely that these individuals all shared low economic resources in life due to their inclusion in the UI-SC. This partiality towards individuals of low socioeconomic status is, unfortunately, quite common in bioarchaeology because their remains are less protected and more accessible than higher-status individuals. Furthermore, the failure of these individuals to be buried indicates their lack of social capital, or inclusion, which is indicative of their value to their family or society (Whitney 2019, 10). The health of these individuals in the UI-SC sample was recorded through the analysis of a variety of skeletal indicators and pathologies, including tuberculosis, cribra orbitalia, porotic hyperostosis, periostitis, osteomyelitis, antemortem tooth loss, and linear enamel hypoplasia.

This research has important implications for the relationship between health, culture, and disease. Although individuals in this sample cannot be shown to have experienced negative impacts on their health due to racism, despite having abundant evidence of its existence in the historical record, it has been proven to negatively impact peoples' health in other studies (Harrod and Crandall 2015, 152; Goodman 2016, 74; Kuzawa 2016, 89). Overall, though, limited access to resources was shown to play a very important (albeit negative) role in the health of people in this sample. The health of immigrants in the past would have been improved by access to medical and dental care, along with nutritious food and improved living conditions. This is also true for modern immigrants. Immigrants to the United States today often experience overall health deteriorations due to their exposure to the unhealthy diets, American lifestyles, and lack of access to health care. Even though health care has improved since the early 1900s, modern immigrants still suffer some of the same social inequalities as immigrants in the past due to the issue of access – meaning that because many immigrants do not have access to health care, it does not have any positive impact on their health at all.

The analysis of skeletal indicators and pathologies in the UI-SC sample ultimately demonstrated that significant differences in their health were due to neither sex nor immigration status. Several health indicators, such as the frequency of porotic hyperostosis and periostitis in the sample, implied that health-related conditions in San Francisco may have actually improved since 1900 based on comparisons to the Golden Gate Cemetery population observed by Buzon and colleagues in 2005. However, the rate of antemortem tooth loss appeared to increase in the UI-SC sample overall compared to individuals from the Golden Gate Cemetery, most likely due to exposure to carbohydrate-rich diets and a lack of dental health care. Overall, individuals in the UI-SC sample appeared to have similar health markers whether they were born in the United States or immigrated there during their lifetimes. Their remains indicated that their lives were difficult, although not as harsh as the lives of African slaves in colonial America through the nineteenth century (Blakey 2010, 66; Frohne 2015, 154, 160).

Lastly, despite significant historical evidence of rampant racism, it appears that low economic status had the largest impact on the health of the 144 individuals included in this sample. This does not conclude that racism did not play a role in their lives as it still likely impacted the general socioeconomic status of these individuals, but instead that it is not directly observable in this study. Additional research is needed to more broadly understand the relationship between health, culture, and disease, and the ways in which they manifest in physical remains, in turn of the twentieth century San Francisco.

BIBLIOGRAPHY

Acevedo-Garcia, Dolores, Sanchez-Vaznaugh, Emma V, Viruell-Fuentes, Edna A, and Almeida, Joanna. 2012. "Integrating Social Epidemiology into Immigrant Health Research: A Cross-National Framework." *Social Science & Medicine* 75 (12). Elsevier Ltd: 2060–68.

Adams, Mark B., Allen, Garland E. and Sheila Faith Weiss. 2005. "Human Heredity and Politics: A Comparative Institutional Study of the Eugenics Record Office at Cold Spring Harbor (United States), the Kaiser Wilhelm Institute for Anthropology, Human Heredity, and Eugenics (Germany), and the Maxim Gorky Medical Genetics Institute (USSR)." *Osiris* 20 (January): 232–62.

Allen, Garland E. 2013. "'Culling the Herd': Eugenics and the Conservation Movement in the United States, 1900-1940." *Journal of the History of Biology* 46 (1): 31–72.

Amoroso, Alexandra, Garcia, Susana J., and Cardoso, Hugo F. V. "Age at Death and Linear Enamel Hypoplasias: Testing the Effects of Childhood Stress and Adult Socioeconomic Circumstances in Premature Mortality." *American Journal of Human Biology* 26, no. 4 (July 2014): 461–468.

Armelagos, George J., and Gerven, Dennis P. Van. "A Century of Skeletal Biology and Paleopathology: Contrasts, Contradictions, and Conflicts." *American Anthropologist* 105, no. 1 (March 2003): 53–64.

Baker, Lee D. 1998. *From Savage to Negro Anthropology and the Construction of Race, 1896-1954* Berkeley: University of California Press.

Bakhtiari, Elyas. 2018. "Immigrant Health Trajectories in Historical Context: Insights from European Immigrant Childhood Mortality in 1910." *SSM - Population Health* 5 (August). Elsevier Ltd: 138–46.

Banton, Michael. 2012. "The Colour Line and the Colour Scale in the Twentieth Century." *Ethnic and Racial Studies* 35 (7): 1109–31.

Bass, William M. *Human osteology: a Laboratory and Field Manual*. Missouri Archaeological Society, 1987.

Berglund, Barbara. "Chinatown's Tourist Terrain: Representation and Racialization in Nineteenth-Century San Francisco." *American Studies* 46, no. 2 (2005): 5-36.

Bernard, H. Russell. 2011. *Research Methods in Anthropology : Qualitative and Quantitative Approaches* 5th ed. Lanham, Md: AltaMira Press.

Blakey, Michael L. 2001. "Bioarchaeology of the African Diaspora in the Americas: Its Origins and Scope." *Annual Review of Anthropology* 30 (1): 387–422.

Blakey, Michael L. 2010. "African Burial Ground Project: Paradigm for Cooperation?" *Museum I International* 62 (1-2): 61-68.

Buikstra, Jane E. "The Lower Illinois River Region: A Prehistoric Context for the Study of Ancient Diet and Health." In *Paleopathology at the Origins of Agriculture*, edited by Mark Nathan Cohen and George J. Armelagos, 215-234. Academic Press, Inc., Orlando, 1984.

Burchell, R. A. "The Irish of San Francisco 1848-80." *Current Anthropology* 19, no. 2 (June 1, 1978): 458.

Buzon, Michele, Walker, Phillip, Verhagen, Francine, and Kerr, Susan. 2005. "Health and Disease in Nineteenth-Century San Francisco: Skeletal Evidence from a Forgotten Cemetery." *Historical Archaeology* 39 (2). Cham: Springer International Publishing: 1–15.

California State Board of Health. 1871. *First Biennial Report of the State Board of Health of California For the Years 1870 and 1871*. Sacramento: D.W. Gelwicks, State Printer.

California State Board of Health. 1886. *Ninth Biennial Report of the State Board of Health of California For the Fiscal Years from June 30, 1884, to June 30, 1886*. Sacramento: James J. Ayers, Supt. State Printing.

California State Board of Health. 1916. *Tuberculosis primer for school children.* Sacramento: California State Printing Office.

Chase-Riboud, Barbara. 2009. "Slavery as a Problem in Public History: Or Sally Hemings and the 'One Drop Rule' of Public History." *Callaloo* 32 (3): 826–31.

Cherny, Robert W., Irwin, Mary Ann, and Wilson, Ann Marie. 2011. *California Women and Politics from the Gold Rush to the Great Depression* Lincoln: University of Nebraska Press.

Cook, Della Collins. "Subsistence and Health in the Lower Illinois Valley: Osteological Evidence." In *Paleopathology at the Origins of Agriculture*, edited by Mark Nathan Cohen and George J. Armelagos, 235-269. Academic Press, Inc., Orlando, 1984.

Craddock, Susan. "Sewers and Scapegoats: Spatial Metaphors of Smallpox in Nineteenth Century San Francisco." *Social Science & Medicine* 41, no. 7 (1995): 957-68.

Craddock, Susan. "Tuberculosis, Tenements and the Epistemology of Neglect: San Francisco in the Nineteenth Century." *Ecumene* 5, no. 1 (1998): 53-80.

Dancis, Bruce. "Social Mobility and Class Consciousness: San Francisco's International Workmen's Association in the 1880s." *Journal of Social History* 11, no. 1 (1977): 75-98.

Daniels, Roger. 1997. "No Lamps Were Lit for Them: Angel Island and the Historiography of Asian American Immigration." *Journal of American Ethnic History* 17 (1). Transaction Periodicals Consortium: 3–18.

De Graauw, Els, and Vermeulen, Floris. "Cities and the Politics of Immigrant Integration: a Comparison of Berlin, Amsterdam, New York City, and San Francisco." *Journal of Ethnic and Migration Studies* 42, no. 6 (May 2, 2016): 989–1012.

Derickson, Alan. 2018. "Naphtha Drunks, Lead Colic, and the Smelter Shakes: The Inordinate Exposure of Immigrant Workers to Occupational Health Hazards at the Turn of the Twentieth Century." *Journal of American Ethnic History* 37 (2). University of Illinois Press: 37–61.

DeWitte, Sharon N. and Stojanowski, Christopher M. 2015. "The Osteological Paradox 20 Years Later: Past Perspectives, Future Directions." *Journal of Archaeological Research* 23 (4): 397–450.

Dove, Nah. 2018. “Race Revisited: Against a Cultural Construction Bearing Significant Implications.” *International Journal of African Renaissance Studies - Multi-, Inter- and Transdisciplinarity* 13 (2): 129–43.

Driscoll, Elizabeth Monahan and David S. Weaver. “Dental Health and Late Woodland Subsistence in Coastal North Carolina.” In *Bioarchaeological Studies of Life in the Age of Agriculture A View from the Southeast*, edited by Patricia M. Lambert, 148-167. Tuscaloosa: University of Alabama Press, 2000.

Epstein, Terrie. "The Pride and Pain of Chinese Immigration: Folk Rhymes from San Francisco’s Chinatown." *OAH Magazine of History* 5, no. 2 (1990): 51-54.

Fairchild, Amy L. 2004. “Policies of Inclusion: Immigrants, Disease, Dependency, and American Immigration Policy at the Dawn and Dusk of the 20th Century.” *American Journal of Public Health* 94 (4): 528–39.

Fischer, Bernard A. 2012. “Maltreatment of People With Serious Mental Illness in the Early 20th Century: A Focus on Nazi Germany and Eugenics in America.” *The Journal of Nervous and Mental Disease* 200 (12): 1096–1100.

Frohne, Andrea E. 2015. *The African Burial Ground in New York City Memory, Spirituality, and Space.* First edition. Syracuse, New York: Syracuse University Press.

Gardner, M. M. "Working on White Womanhood: White Working Women in the San Francisco Anti-Chinese Movement, 1877-1890." *Journal of Social History* 33, no. 1 (1999): 73-95.

Geber, Jonny. “Skeletal Manifestations of Stress in Child Victims of the G Reat I Rish F Amine (1845–1852): Prevalence of Enamel Hypoplasia, Harris Lines, and Growth Retardation.” *American Journal of Physical Anthropology* 155, no. 1 (September 2014): 149–161.

Gold, Debra L. “’Utmost Confusion’ Reconsidered: Bioarchaeology and Secondary Burial in Late Prehistoric Interior Virginia.” In *Bioarchaeological Studies of Life in the Age of Agriculture A View from the Southeast*, edited by Patricia M. Lambert, 195-218. Tuscaloosa: University of Alabama Press, 2000.

Goodman, Alan H. “Disease and dying while black: how racism, not race, gets under the skin.” In *New Directions in Biocultural Anthropology*, edited by Molly K. Zuckerman and Debra L. Martin, 69-87. John Wiley & Sons. 2016.

Goodman, Alan H., Lallo, John, Amelagos, George J. and Jerome C. Rose. “Health Changes at Dickson Mounds, Illinois (A.D. 950-1300).” In *Paleopathology at the Origins of Agriculture*, edited by Mark Nathan Cohen and George J. Armelagos, 271-305. Academic Press, Inc., Orlando, 1984a.

Goodman, Alan H., Martin, Debra L., Armelagos, George J., and George Clark. “Indications of Stress from Bone and Teeth.” In *Paleopathology at the Origins of Agriculture*, edited by Mark Nathan Cohen and George J. Armelagos, 13-49. Academic Press, Inc., Orlando, 1984b.

Goodman, Alan. 2006. “Two Questions About Race.” *Is "Race" Real?* Social Science Research Council. June 7. http://raceandgenomics.ssrc.org/Goodman/.

Hall, Nicholas Sean. 2013. "The WASP's 'Troublesome Children': Culture, Satire, and the Anti-Chinese Movement in the American West." *California History* 90 (2): 42–76.

Hankin, Janet R, and Wright, Eric R. 2010. "Reflections on Fifty Years of Medical Sociology." *Journal of Health and Social Behavior* 51. Los Angeles, CA: SAGE Publications: S10–S14.

Harrod, Ryan, and Crandall, John. "Rails Built of the Ancestors' Bones: The Bioarchaeology of the Overseas Chinese Experience." *Historical Archaeology* 49, no. 1 (March 2015): 148–161.

Hoetink, Harmannus. "Resource Competition, Monopoly, and Socioracial Diversity." In *Ethnicity and Resource Competition in Plural Societies,* edited by Britta Mondorf, and Leo A. Despres, 9-26. De Gruyter, Inc., 1975.

Imperato, Pascal, and Imperato, Gavin. 2008. "The Medical Exclusion of an Immigrant to the United States of America in the Early Twentieth Century. The Case of Cristina Imparato." *Journal of Community Health* 33 (4). Boston: Springer US: 225–40.

Issel, William. ""Citizens Outside the Government": Business and Urban Policy in San Francisco and Los Angeles, 1890-1932." *Pacific Historical Review* 57, no. 2 (1988): 117-45.

Keller, George F, "A Hard Job," *The Illustrated WASP*, August 10, 1878b.

Keller, George F, "Uncle Sam's Farm in Danger." *The Illustrated WASP*, March 9, 1878a.

Khanna, Nikki. 2010. "'If You're Half Black, You're Just Black': Reflected Appraisals and the Persistence of the One-Drop Rule." *The Sociological Quarterly* 51 (1): 96–121.

Keenleyside, Anne. 1998. "Skeletal Evidence of Health and Disease in Pre-contact Alaskan Eskimos and Aleuts." *American Journal of Physical Anthropology* 107 (1): 51–70.

Kraut, Alan M. 1994. *Silent Travelers : Germs, Genes, and the "Immigrant Menace"* New York, NY: BasicBooks

Kroeber, A. "The Superorganic." *American Anthropologist* 19, no. 2 (1917): 163-213.

Kuzawa, Christopher W., Clarence C. Gravlee. "Beyond genetic race: biocultural insights into the causes of racial health disparities." In *New Directions in Biocultural Anthropology*, edited by Molly K. Zuckerman and Debra L. Martin, 89-105. John Wiley & Sons. 2016.

Lambert, Patricia M. "Life on the Periphery: Health in Farming Communities of Interior North Carolina and Virginia." In *Bioarchaeological Studies of Life in the Age of Agriculture A View from the Southeast*, edited by Patricia M. Lambert, 168-194. Tuscaloosa: University of Alabama Press, 2000.

Larsen, Clark Spencer and Leslie E. Sering. "Inferring Iron-Deficiency Anemia from Human Skeletal Remains: The Case of Georgia Bight." In *Bioarchaeological Studies of Life in the Age of Agriculture A View from the Southeast*, edited by Patricia M. Lambert, 116-133. Tuscaloosa: University of Alabama Press, 2000.

Lawlor, Allison. *The Saddest Ship Afloat: The Tragedy of the MS St. Louis*, Nimbus Publishing, Limited, 2016.

Lee, Jennifer, and Bean, Frank D. 2007. "Reinventing the Color Line Immigration and America's New Racial/Ethnic Divide." *Social Forces* 86 (2). The University of North Carolina Press: 561–86.

Lew-Williams, Beth. 2017. "'Chinamen' and 'Delinquent Girls': Intimacy, Exclusion, and a Search for California's Color Line." *Journal of American History* 104 (3): 632–55.

Li, Chuo. 2012. "The Politics and Heritage of Race and Space in San Francisco's Chinatown." In *On Location: Heritage Cities and Sites*. 37-59. New York, NY: Springer New York.

Liebe-Harkort, Carola. "Exceptional rates of dental caries in a scandinavian Early Iron Age population—A study of dental pathology at Alvastra, Östergötland, Sweden." *International Journal of Osteoarchaeology* 22, no. 2 (2012): 168-184.

Link, Bruce G., and Phelan, Jo. 1995. "Social Conditions As Fundamental Causes of Disease." *Journal of Health and Social Behavior*, January. American Sociological Association, 80–94

Lopez, Belen, Antonio F. Pardinas, Eva Garcia-Vazquez, and Eduardo Dopico. "Socio-cultural factors in dental diseases in the Medieval and early Modern Age of northern Spain." *Homo* 63, no. 1 (2012): 21-42.

Lukacs, John R. "Dental trauma and antemortem tooth loss in prehistoric Canary Islanders: prevalence and contributing factors." *International Journal of Osteoarchaeology* 17, no. 2 (2007): 157-173.

Markel, Howard. 1998. "Caring for the Foreign Born: The Health of Immigrant Children in the United States, 1890-1925." *Archives of Pediatrics & Adolescent Medicine* 152 (10). American Medical Association: 1020–27.

Marklein, Kathryn E., Leahy, Rachael E., and Crews, Douglas E. "In Sickness and in Death: Assessing Frailty in Human Skeletal Remains." *American Journal of Physical Anthropology*161, no. 2 (October 2016): 208–225.

Marks, Lara, and Worboys, Michael. 1997. *Migrants, Minorities, and Health : Historical and Contemporary Studies* London ;: Routledge.

Nieves Delgado, Abigail. 2018. "Science, Politics and the Production of Biological Knowledge: New Trends and Old Challenges." *Journal for General Philosophy of Science* 49 (3): 467–73.

Nystrom, Kenneth C. "Postmortem Examinations and the Embodiment of Inequality in 19th Century United States." *International Journal of Paleopathology* 1, no. 3-4 (December 2011): 164–172.

Ortner, Donald J., and Putschar, Walter G. J. *Identification of Pathological Conditions in Human Skeletal Remains* Washington: Smithsonian Institution Press, 1981.

Paddison, Joshua. "Anti-Catholicism and Race in Post-Civil War San Francisco." *Pacific Historical Review* 78, no. 4 (November 1, 2009): 505–544.

Pamuk, Ayse. "Geography of Immigrant Clusters in Global Cities: A Case Study of San Francisco." *International Journal of Urban and Regional Research* 28, no. 2 (2004): 287-307.

Pechenkina, Ekaterina A., and Delgado, Mercedes. 2006. "Dimensions of Health and Social Structure in the Early Intermediate Period Cemetery at Villa El Salvador, Peru." *American Journal of Physical Anthropology* 131 (2). Hoboken: Wiley Subscription Services, Inc., A Wiley Company: 218–35.

Powell, Mary Lucas. "Ancient Diseases, Modern Perspectives: Treponematosis and Tuberculosis in the Age of Agriculture." In *Bioarchaeological Studies of Life in the Age of Agriculture A View from the Southeast*, edited by Patricia M. Lambert, 6-34. Tuscaloosa: University of Alabama Press, 2000.

Reeves, Marianne. "Dental Health at Early Historic Fusihatchee Town: Biocultural Implications of Contact in Alabama." In *Bioarchaeological Studies of Life in the Age of Agriculture A View from the Southeast*, edited by Patricia M. Lambert, 78-95. Tuscaloosa: University of Alabama Press, 2000.

Reitsema, Laurie J, and Giuseppe Vercellotti. 2012. "Stable Isotope Evidence for Sex – and Status – based Variations in Diet and the Life History at Medieval Trino Vercellese, Italy." American Journal of Physical Anthropology 148 (4): 589-600.

Sabbah, W, Tsakos, G, Sheiham, A, and Watt, R G. "The Effects of Income and Education on Ethnic Differences in Oral Health: a Study in US Adults." *Journal of Epidemiology and Community Health* 63, no. 7 (July 1, 2009): 516–520.

Samille Biasi, Miranda, Anna Paula de Rosa Possebon, Alessandra Julie Schuster, Raissa Micaella Marcello-Machado, Luciana Pinto, and Fernanda Faot. 2019. "Relationship Between Masticatory Function Impairment and Oral Health-Related Quality of Life of Edentulous Patients: An Interventional Study." *Journal of Prosthodontics* 28 (6): 634-642.

Schmidt, Ryan, Seguchi, Noriko, and Thompson, Jennifer. "Chinese Immigrant Population History in North America Based on Craniometric Diversity." *Anthropological science* 119, no. 1 (January 1, 2011): 9–20.

Smith, Andrew F. *Potato a Global History*. London: Reaktion Books, 2011.

Sołtysiak, Arkadiusz. 2015. "The Osteological Paradox, Selective Mortality, and Stress Markers Revisited." *Current Anthropology* 56 (4): 569–70.

Spencer, Herbert, "The Social Organism," In *Anthropological Theory: An Introductory History*, ed. R. Jon McGee & Richard L. Warms, 16-44. Lanham, MD: Rowman and Littlefield Publishing Group, 2017.

Steckel, Richard H., Rose, Jerome C., Spencer Larsen, Clark, and Walker, Phillip L. "Skeletal Health in the Western Hemisphere from 4000 B.C. to the Present." *Evolutionary Anthropology: Issues, News, and Reviews* 11, no. 4 (2002): 142–155.

Sueyoshi, Amy. "Mindful Masquerades: Que(e)rying Japanese Immigrant Dress in Turn-of-the-Century San Francisco." *Frontiers: A Journal of Women Studies* 26, no. 3 (January 1, 2005): 67–100.

Takao Ozawa v. United States. 260 U.S. 178 (1922).

Thomas, David Hurst. 1986. *Refiguring Anthropology : First Principles of Probability & Statistics* Prospect Heights, IL: Waveland Press.

Torres-Rouff, Christina, Kelly J. Knudson, William J. Pestle, and Emily M. Stovel. "Tiwanaku Influence and Social Inequality: A Bioarchaeological, Biogeochemical, and Contextual Analysis of the Larache Cemetery, San Pedro De Atacama, Northern Chile." *American Journal of Physical Anthropology* 158, no. 4 (2015): 592-606.

Trombley, Trent M., Sabrina C. Agarwal, Patrick D. Beauchesne, Caroline Goodson, Francesca Candilio, Alfredo Coppa, and Mauro Rubini. "Making sense of medieval mouths: Investigating sex differences of dental pathological lesions in a late medieval Italian community." *American Journal of Physical Anthropology* 169, no. 2 (2019): 253-269.

Van Nuys, Frank W. 1994. "A Progressive Confronts the Race Question: Chester Rowell, the California Alien Land Act of 1913, and the Contradictions of Early Twentieth-Century Racial Thought." *California History* 73 (1): 2–13.

Wang, Joan S. "The Double Burdens of Immigrant Nationalism: The Relationship Between Chinese and Japanese in the American West, 1880s-1920s." *Journal of American Ethnic History* 27, no. 2 (January 1, 2008): 28–58.

Waters, M C. 2000. "Immigration, Intermarriage, and the Challenges of Measuring Racial/ethnic Identities." *American Journal of Public Health* 90 (11): 1735–37

Weiss, Nicole M, Giuseppe Vercellotti, Rosa Boano, Marilena Girotti, and Sam D Stout. 2019. "Body Size and Social Status in Medieval Alba (Cuneo), Italy." *American Journal of Physical Anthropology* 168 (3): 595–605.

White, Tim D., and Pieter A. Folkens. *The Human Bone Manual*. Amsterdam: Elsevier Academic Press, 2005.

Whitney, Dawn T. 2019. "Demography, Risk, and Power: An Examination of the Deceased Patient Population at the Hastings State Hospital, 1900-1978." Minnesota State University, Mankato.

Wright, Lori, and Yoder, Cassady. "Recent Progress in Bioarchaeology: Approaches to the Osteological Paradox." *Journal of Archaeological Research* 11, no. 1 (March 2003): 43–70.

Wood, James W., Milner, George R., Harpending, Henry C., Weiss, Kenneth M., Cohen, Mark N., Eisenberg, Leslie E., Hutchinson, Dale L., et al. "The Osteological Paradox: Problems of Inferring Prehistoric Health from Skeletal Samples [and Comments and Reply]." *Current Anthropology* 33, no. 4 (August 1, 1992): 343–370.

Yamaga, Eijiro, Yusuke Sato, and Shunsuke Minakuchi. 2018. "An Intervention Study to Test Locker's Conceptual Framework of Oral Health in Edentulous Elders." *Gerodontology*
35 (3): 260–267.

Yamato, Alexander. 1994. "Racial Antagonism and the Formation of Segmented Labor Markets: Japanese Americans and their Exclusion from the Work Force." *Humboldt Journal of Social Relations* 20 (1). Humboldt State University: 31–63.

Yang, Joshua. 2010. “Contextualizing Immigrant Access to Health Resources.” *Journal of Immigrant and Minority Health* 12 (3). Boston: Springer US: 340–53.

Yaussy, Samantha L. 2019. “The Intersections of Industrialization: Variation in Skeletal Indicators of Frailty by Age, Sex, and Socioeconomic Status in 18th- and 19th-century England.” *American Journal of Physical Anthropology* 170 (1): 116-30.

Zimmer, Kenyon. 2015. *Immigrants Against the State : Yiddish and Italian Anarchism in America* Urbana, Illinois: University of Illinois Press.

Zhou, Min, and John R. Logan. 1991. “In and Out of Chinatown: Residential Mobility and Segregation of New York City’s Chinese.” *Social Forces* 70 (2): 387-407.

Zuckerman, Molly K., and John Crandall. “Reconsidering Sex and Gender in Relation to Health and Disease in Bioarchaeology.” *Journal of Anthropological Archaeology* 54 (2019): 161–71.

APPENDIX: Data

Table 1. General Demographics

Skeleton ID Number	**Sex**	**Age**	**Ancestral Affiliation***	**Region of birth**	**Immigrant to US**
94B	Male	Adult	Unknown	Unknown	Unknown
115A	Male	Adult	Unknown	Unknown	Unknown
1375	Female	Adult	Unknown	Unknown	Unknown
9A	Male	Adult	Unknown	Unknown	Unknown
81	Female	Adult	Unknown	Unknown	Unknown
61	Female	Adult	Unknown	Unknown	Unknown
71	Female	Adult	Unknown	Unknown	Unknown
79A	Female	Adult	Unknown	Unknown	Unknown
85B	Female	Adult	Unknown	Unknown	Unknown
90	Male	Adult	Unknown	Unknown	Unknown
91A	Mae	Adult	Unknown	Unknown	Unknown
96B	Male	Adult	Unknown	Unknown	Unknown
612	Male	Adult - 69	White, Italian	Southern Europe	Y
625	Male	Adult - 60	White, Californian	United States	N
634	Male	Adult - 76	White, Wisconsin	United States	N
650	Male	Adult - 70	White, Indiana	United States	N
671	Male	Adult - 57	White, Italian	Southern Europe	Y
703	Female	Adult - 79	White, Indiana	United States	N
717	Male	Adult - 50	White, Nebraska	United States	N
721	Male	Adult - 64	White, Russian	Russia	Y
732	Male	Adult - 65	White, Iowa	United States	N
736	Male	Adult - 67	White, Italian	Southern Europe	Y
743	Female	Adult - 54	White, Indiana	United States	N
746	Male	Adult - 59	Black	Unknown	Unknown
753	Male	Adult - 61	White, Kentucky	United States	N
734	Male	Adult - 67	White, Austria	Central Europe	Y
766	Male	Adult - 55	White, France	Western Europe	Y
775	Male	Adult - 53	White, Japan	Eastern Asia	Y
805	Male	Adult - 67	White, Denmark	Northern Europe	Y
833	Male	Adult - 66	White, Sweden	Northern Europe	Y
950	Male	Adult - 72	Unknown, English	British Isles	Y
840	Male	Adult - 66	White, Canada	Canada	Y
844	Male	Adult - 71	White, Italian	Southern	Y

				Europe	
843	Male	Adult - 63	White, Missouri	United States	N
849	Male	Adult - 84	White, Ireland	British Isles	Y
853	Male	Adult - 60	White, Pennsylvania	United States	N
856	Male	Adult - 86	White, Ireland	British Isles	Y
862	Female	Adult	Unknown, New York	United States	N
864	Male	Adult - 83	White, Illinois	United States	N
866	Male	Adult - 79	White, Italian	Southern Europe	Y
867	Male	Adult - 73	White, Switzerland	Western Europe	Y
868	Male	Adult - 69	White, Michigan	United States	N
871	Male	Adult - 75	White, Illinois	United States	N
872	Male	Adult - 75	White, New York	United States	N
873	Male	Adult - 74	White, California	United States	N
874	Male	Adult - 80	White, Scotland	British Isles	Y
875	Female	Adult - 84	White, Canada	Canada	Y
876	Male	Adult - 87	White, Ireland	British Isles	Y
877	Male	Adult - 54	White, Central America	Central America	Y
878	Male	Adult - 66	White, Germany	Western Europe	Y
879	Male	Adult	Unknown	Unknown	Unknown
881	Male	Adult - 63	White, California	United States	N
882	Female	Adult - 66	White, Oregon	United States	N
884	Male	Adult	Unknown	Unknown	Unknown
889	Male	Adult - 60	Black, Kansas	United States	N
890	Male	Adult - 50	White, Kentucky	United States	N
891	Male	Adult - 83	White, Pennsylvania	United States	N
892	Male	Adult - 86	Chinese, China	Eastern Asia	Y
894	Male	Adult	Unknown	Unknown	Unknown
897	Male	Adult - 81	Japanese, Japan	Eastern Asia	Y
898	Male	Adult - 67	Unknown	Unknown	Unknown
899	Male	Adult - 58	Unknown, Greece	Southern Europe	Y
900	Female	Adult	Unknown	Unknown	Unknown
902	Male	Adult - 70	Unknown, New Orleans	United States	N
904	Male	Adult - 28	Chinese, China	Eastern Asia	Y
905	Male	Adult - 77	Unknown,	British Isles	Y

			England		
906	Male	Adult - 65	Unknown, Finland	Northern Europe	Y
908	Male	Adult - 75	Unknown, England	British Isles	Y
909	Female	Adult - 67	White	Unknown	Unknown
910	Female	Adult	Unknown	Unknown	Unknown
911	Male	Adult	Unknown	Unknown	Unknown
913	Male	Adult - 74	White	Unknown	Unknown
918	Male	Adult - 68	White, Kansas	United States	N
920	Male	Adult - 70	White, Canada	Canada	Y
923	Male	Adult - 60	White, New York	United States	N
925	Male	Adult - 85	White, Illinois	United States	N
928	Male	Adult - 83	Chinese, China	Eastern Asia	Y
929	Male	Adult - 64	White, Illinois	United States	N
930	Male	Adult - 88	Chinese, China	Eastern Asia	Y
931	Male	Adult - 79	Chinese, China	Eastern Asia	Y
933	Male	Adult - 96	White, France	Western Europe	Y
936	Male	Adult - 68	White, Illinois	United States	N
937	Male	Adult - 62	White, Massachusetts	United States	N
942	Male	Adult - 89	White, Switzerland	Western Europe	Y
946	Female	Adult - 82	Unknown, Iowa	United States	N
953	Male	Adult - 84	Unknown, California	United States	N
955	Male	Adult - apx. 47	White, USA	United States	N
956	Male	Adult - 48	Black, Unknown	Unknown	Unknown
957	Male	Adult - 55	White, California	United States	N
958	Male	Adult - 68	White, California	United States	N
959	Female	Adult - 61	White, Illinois	United States	N
961	Male	Adult - 76	White, Denmark	Northern Europe	Y
964A	Male	Adult	Unknown	Unknown	Unknown
967	Male	Adult - 80	White, France	Western Europe	Y
971	Male	Adult	Unknown	Unknown	Unknown
975	Male	Adult	Unknown	Unknown	Unknown
977	Female	Adult - 74	White, Ireland	British Isles	Y
978	Male	Adult - 85	White, Ireland	British Isles	Y
981	Female	Adult - 74	White, South Carolina	United States	N
982	Male	Adult - 40	Mexican, Mexico	Mexico	Y
985	Female	Adult	Unknown	Unknown	Unknown

986	Male	Adult - 65	White, Massachusetts	United States	N
987	Male	Adult	Unknown	Unknown	Unknown
988	Female	Adult	Unknown	Unknown	Unknown
1001	Female	Adult	Unknown	Unknown	Unknown
1003	Male	Adult - 79	Unknown, Massachusetts	United States	N
1007	Female	Adult - 68	Unknown, Ohio	United States	N
1009	Female	Adult - 74	Unknown, England	British Isles	Y
1010	Male	Adult - 33	Unknown, Iowa	United States	N
1026	Male	Adult - 37	White, Spain	Western Europe	Y
1030	Male	Adult - 70	White, Ireland	British Isles	Y
1035	Male	Adult - 71	White, Italy	Southern Europe	Y
1037	Male	Adult - 59	White, Sweden	Northern Europe	Y
1106	Female	Adult - 71	Unknown, Illinois	United States	N
1108	Male	Adult	Unknown, Germany	Western Europe	Y
1112	Male	Adult - 82	Unknown, Germany	Western Europe	Y
1115	Male	Adult - 65	Unknown, Germany	Western Europe	Y
1127	Male	Adult - 69	White, Unknown	Unknown	Unknown
1154	Male	Adult - 80	White, Italy	Southern Europe	Y
1244	Female	Adult - 54	White, Texas	United States	N
1262	Male	Adult - 81	White, Germany	Western Europe	Y
1399	Female	Adult - 74	White, England	British Isles	Y
1403	Male	Adult - 73	White, Sweden	Northern Europe	Y
1411	Male	Adult - 63	Unknown	Unknown	Unknown
1412	Male	Adult - 76	Mongolian, Japan	Eastern Asia	Y
1427	Female	Adult - 75	White, Maine	United States	N
1434	Male	Adult - 78	White, Indiana	United States	N
1439	Male	Adult - 80	White, California	United States	N
1443	Male	Adult - 63	White, Austria	Central Europe	Y
1145	Male	Adult - 85	White, Denmark	Northern Europe	Y
1453	Male	Adult	Unknown	Unknown	Unknown
1454	Male	Adult - 77	Unknown	Unknown	Unknown
1457	Male	Adult - 73	White, USA	United States	N

1458	Male	Adult - 81	White, New York	United States	N
1465	Male	Adult - 77	Unknown, Sweden	Northern Europe	Y
1470	Female	Adult - 86	Unknown, Germany	Western Europe	Y
1484	Male	Adult - 74	White, Illinois	United States	N
1491	Male	Adult - 71	Mexican, Mexico	Mexico	Y
1494	Male	Adult - 85	Mexican, Mexico	Mexico	Y
1495	Male	Adult - 78	White, Unknown	Unknown	Unknown
1533	Female	Adult - 60	White, Ohio	United States	N
1576	Female	Adult - 87	White, Unknown	Unknown	Unknown
638A	Male	Adult - 70	Chinese, China	Eastern Asia	Y
901A	Male	Adult - 70	Colored, Texas	United States	N

*as recorded by medical professionals at Stanford University

Table 2. Skeletal Health Markers and Pathologies

Skeleton ID Number	Tuberculosis	Cribra Orbitalia	Porotic Hyperostosis	Periostitis	Osteomyelitis
94B	Not present	Not observable	Not present	Not present	Not present
115A	Not present	Not observable	Not present	Not present	Not present
1375	Not observable	Not Present	Not present	Not present	Not present
9A	Not observable	Not Present	Yes - very slight/healed	Not present	Not present
81	Not present	Not observable	Not present	Not present	Not present
61	Not present	Not observable	Not observable	Not observable	Not observable
71	Not observable	Not observable	Yes - very slight; might just be infection (non-anemia related)	Not observable	Not observable
79A	Not observable	Not observable	Not present	Yes - right tibia; active or beginning to heal	Not present
85B	Not present	Not observable	Not present	Not present	Not present
90	Not present	Not present	Not present	Not present	Not present
91A	Not observable	Not observable	Not present	Not observable	Not observable
96B	Not present	Not observable	Not observable	Not present	Not present
612	Not present	Not observable	Not present	Not present	Not present
625	Not observable	Not observable	Not present	Not present	Not present
634	Not present	Not present	Not present	Not present	Not present
650	Not present	Not present	Not present	Not present	Not present
671	Not observable	Not observable	Not present	Not present	Not present
703	Not observable	Not observable	Not present	Not present	Not present
717	Not observable	Not observable	Not present	Not present	Not present
721	Not observable	Not observable	Not present	Not present	Not present
732	Not observable	Not Present	Not present	Not present	Not present
736	Not observable	Not observable	Not present	Not present	Not present
743	Not observable	Not observable	Not present	Not present	Not present
746	Not observable	Not observable	Not present	Not observable	Not observable

753	Not observable	Not observable	Not present	Not present	Not present
734	Not observable	Not observable	Not present	Not present (left tibia present only)	Not present
766	Not observable	Not observable	Not present	Not present	Not present
775	Not observable	Not observable	Not present	Not present	Not present
805	Not observable	Not observable	Not present	Not present	Not present
833	Not observable	Not observable	Not present	Not present	Not present
950	Not present	Not observable	Not present	Not present	Not present
840	Not observable	Not observable	Not present	Not present	Not present
844	Not observable	Not observable	Not present	Not present	Not present
843	Not observable	Not observable	Not present	Not present	Not present
849	Not observable	Not observable	Not present	Not present (right tibia present only)	Not present (right tibia present only)
853	Not observable	Not observable	Yes - healed, or lesions might be related to obliteration of sagittal suture	Not present	Not present
856	Not observable	Not observable	Not present	Not present	Not present
862	Not observable	Not observable	Not observable	Not present	Not present
864	Not observable	Not observable	Not present	Not present	Not present
866	Not observable	Not observable	Not present	Not observable	Not observable
867	Not observable	Not observable	Not present	Not present	Not present
868	Not observable	Not observable	Not present	Not present (right tibia present only)	Not present (right tibia present only)
871	Not present	Not observable	Not present	Not present	Not present
872	Not observable	Not present	Not present	Not present	Not present
873	Not present	Not present - right eye orbit present only	Not observable	Not present (right tibia present only)	Not present (right tibia present only)
874	Not observable	Not observable	Not present	Not present	Not present
875	Not observable	Not observable	Not observable	Not present	Not present

876	Not observable	Not observable	Not present	Not present	Not present
877	Not observable	Not observable	Not present	Not present	Not present
878	Not observable	Not present - left eye orbit present only	Not present	Not present	Not present
879	Not observable	Not observable	Not present	Not present	Not present
881	Not observable	Not present	Not observable	Yes - right tibia; minor infection	Not present
882	Not observable	Not observable	Not present	Not present (right tibia present only)	Not present (right tibia present only)
884	Not observable	Not observable	Not present	Not present	Not present
889	Not observable	Not observable	Not observable	Not present	Not present
890	Not present	Not present	Not present	Not present	Not present
891	Not observable	Not present	Not present	Not present	Not present
892	Not observable	Not observable	Not present	Not present	Not present
894	Not present	Not present	Not present	Not present	Not present
897	Not observable	Not observable	Not present	Not present	Not present
898	Not observable	Not observable	Not present	Not present	Not present
899	Not observable	Not observable	Not present	Not present	Not present
900	Not observable	Not present	Not present	Not present	Not present
902	Not observable	Not observable	Not present	Not present	Not present
904	Not observable	Not observable	Not present	Not present	Not present
905	Not present	Not present	Not present	Not present	Not present
906	Not present	Not observable	Not present	Not present	Not present
908	Not present	Not observable	Not present	Not present	Not present
909	Not observable	Not observable	Not present	Not present	Not present
910	Not observable	Not observable	Not present	Not present	Not present
911	Not observable	Not observable	Not present	Not present	Not present
913	Not observable	Not observable	Not present	Not present	Not present
918	Not observable	Not observable	Not present	Yes - left tibia, medial portion of shaft, about halfway down; healed	Not present

920	Not observable	Not observable	Not present	Not present	Not present
923	Not observable	Not observable	Not present	Not present	Not present
925	Not observable	Not observable	Not present	Not present (left tibia present only)	Not present (left tibia present only)
928	Not observable	Not observable	Not present	Not present	Not present
929	Not observable	Not observable	Not present	Not present	Not present
930	Not observable	Not observable	Not present	Not observable	Not observable
931	Not observable	Not observable	Not present	Not present	Not present
933	Not observable	Not observable	Not present	Not present	Not present
936	Not observable	Not observable	Not present	Not present	Not present
937	Not observable	Not observable	Not present	Not present	Not present
942	Not observable	Not observable	Not observable	Not present	Not present
946	Not observable	Not observable	Not present	Not present	Not present
953	Not present	Not observable	Not present	Not present	Not present
955	Not observable	Not observable	Not present	Not present	Not present
956	Not present	Not present	Not present	Not present	Not present
957	Not observable	Not observable	Not present	Not present	Not present
958	Not observable	Not observable	Not observable	Not present	Not present
959	Not observable	Not observable	Not present	Not present	Not present
961	Not observable	Not observable	Not present	Not present	Not present
964A	Not present	Not observable	Not present	Not present	Not present
967	Not observable	Not present - right eye orbit present only	Not present	Not present	Not present
971	Not present	Not observable	Not present	Not present	Not present
975	Not observable	Not observable	Not present	Not present	Not present
977	Not observable	Not present	Not present	Not present	Not present
978	Not observable	Not present	Not present	Not present	Not present
981	Not observable	Not observable	Not present	Not present	Not present
982	Not observable	Not	Not present	Not present	Not present

		observable			
985	Not present	Not observable	Not present	Not present	Not present
986	Not observable	Not observable	Not present	Not present	Not present
987	Not observable	Not observable	Not present	Not present	Not present
988	Not observable	Not observable	Not present	Yes - left and right tibia; left tibia - severe, partially healed, medial distal end and lateral mid-shaft, severe and unhealed; right tibia - severe, partially healed, medial distal end and lateral mid-shaft, minor, unhealed (active)	Not present
1001	Not present	Not observable	Not present	Not present	Not present
1003	Not present	Not observable	Not observable	Not present	Not present
1007	Not observable	Not observable	Not present	Not present (left tibia present only)	Not present (left tibia present only)
1009	Not observable	Not observable	Not present	Not present	Not present
1010	Not observable	Not observable	Not present	Not present	Not present
1026	Not observable	Not observable	Not present	Not present	Not present
1030	Not observable	Not observable	Not present	Not present	Not present
1035	Not present	Not observable	Not present	Not present	Not present
1037	Not observable	Not observable	Not observable	Not present	Not present
1106	Not observable	Not observable	Not present	Not present	Not present
1108	Not present	Not observable	Not present	Not present	Not present
1112	Not observable	Not observable	Not observable	Not present	Not present
1115	Not observable	Not observable	Not present	Not present	Not present
1127	Not observable	Not present	Not present	Not present	Not present
1154	Not observable	Not present -	Not observable	Not present	Not present

		right eye orbit present only			
1244	Not observable	Not observable	Not present	Not present	Not present
1262	Not observable	Not Present	Not observable	Not present	Not present
1399	Not observable	Not observable	Not observable	Not present	Not present
1403	Not observable	Not observable	Not present	Not present	Not present
1411	Not present	Not present - right eye orbit present only	Not present	Not present	Not present
1412	Not observable	Not observable	Not present	Not present	Not present
1427	Not observable	Not observable	Not present	Not present	Not present
1434	Not observable	Not observable	Not present	Not present	Not present
1439	Not observable	Not observable	Not present	Not present (right tibia present only)	Not present (right tibia present only)
1443	Not observable	Not observable	Not present	Not present	Not present
1145	Not observable	Not observable	Not present	Not present	Not present
1453	Not observable	Not present	Not present	Not present	Not present
1454	Not present	Not present	Not present	Not present	Not present
1457	Not observable	Not observable	Not present	Not present (left tibia present only)	Not present (left tibia present only)
1458	Not observable	Not observable	Not present	Not present	Not present
1465	Not observable	Not observable	Not present	Not present	Not present
1470	Not observable	Not observable	Not present	Not present (right tibia present only)	Not present (right tibia present only)
1484	Not present	Not observable	Not present	Not present	Not present
1491	Not observable	Not observable	Not observable	Not present	Not present
1494	Not observable	Not observable	Not present	Not present	Not present
1495	Not present	Not observable	Not present	Not present	Not present
1533	Not observable	Not observable	Not present	Not present	Not present
1576	Not observable	Not observable	Not present	Not present	Not present

638A	Not present	Not observable	Not present	Not observable	Not observable
901A	Not present	Not observable	Not present	Not present	Not present

Table 3. Dental Health Markers and Pathologies

Skeleton ID Number	Antemortem Tooth Loss	LEH	LEH Score
94B	Yes - Right maxillary molars (1, 2, and 3) lost antemortem; left mandibular 3rd molar lost antemortem or never erupted	Not present	1
115A	Yes - Right maxilla - all teeth lost antemortem; mandible - all teeth lost antemortem	Not present	1
1375	Yes - Maxilla - all teeth lost antemortem; mandible not present	Not observable	0
9A	Yes - Left mandibular m1 and m3 missing (m3 might never have existed, not much space); right mandibular m1 and m3 missing (m3 might never have existed, not much space available)	Not present	1
81	Not observable	Not observable	0
61	Yes - Left maxillary premolars missing & m3; left mandibular m1, m2, and m3 missing	Not present	1
71	None	Yes - LEH present on left mandibular i2, c, pm1, pm2; right mandibular i1, i2, c; right maxilla i1, i2, c, pm1	3
79A	Yes - left maxillary c	Not present	1
85B	Yes - all upper right maxillary teeth missing; left mandibular teeth missing	Not observable	0
90	Yes - all right maxillary teeth are missing	Not observable	0
91A	Yes - right maxillary pm1 and pm2	Not present	1
96B	Yes - all mandibular teeth lost antemortem, all maxillary teeth lost antemortem	Not observable	0
612	Yes - left mandibular m1	Not present	1
625	Yes - right mandibular i1, i2, m2, m3; left mandibular m1, m2, m3	Not present	1

634	Yes - maxillary incisors, right maxillary m1, m2, m3; left mandibular pm2, m1, m2 (m3 present but impacted); left mandibular pm1, m1, m2, m3	Not present	1
650	Yes - left maxillary canine (no maxillary m3 present - no room); left mandibular pm2, m2, m3 (?); right mandibular pm2, m1	Not present	1
671	Not observable	Not observable	0
703	Not observable	Not observable	0
717	Not observable	Not observable	0
721	Yes - all mandibular teeth lost antemortem	Not observable	0
732	Yes - right mandible and maxilla present; right mandibular c, pm1, pm2 missing	Not present	1
736	Not observable	Not observable	0
743	Not observable	Not observable	0
746	Yes - upper left mandible present; all teeth lost antemortem	Not observable	0
753	Not observable	Not observable	0
734	Not observable	Not observable	0
766	Not observable	Not observable	0
775	Not observable	Not observable	0
805	No - mandible only present	Not present	1
833	Yes - only left maxilla present, pm1 and m2 missing	Not present	1
950	Not observable	Not observable	0
840	Yes - only left mandible present; pm2, m3 missing	Not present	1
844	Not observable	Not observable	0
843	Not observable	Not observable	0
849	Not observable	Not observable	0
853	Yes - left maxilla and mandible present; left maxillary i1, i2, m2, m3 lost antemortem; right mandibular m3 missing (or never erupted); left mandibular m1, m2, m3 lost antemortem	Yes - LEH present on right mandibular canine	2
856	Yes - mandible present; all teeth lost antemortem	Not observable	0
862	Not observable	Not observable	0
864	Not observable	Not observable	0
866	Yes - left maxilla and	Not present	1

	mandible present; left maxillary m3 missing; left mandible no antemortem tooth loss, right mandibular m3 missing (or never erupted)		
867	Yes - only left maxilla present; i1, i2, c, pm1, pm2, m1, m3 absent	Not present	1
868	Yes - right mandible present; i1, i2, pm1, pm2, m1, m2, m3 antemortem	Not present	1
871	Yes - left mandible present; all teeth lost antemortem	Not observable	0
872	Yes - maxilla and mandible complete; all maxillary teeth lost antemortem; left mandibular m1, m2, m3 lost antemortem; right mandibular pm2, m2, m3 lost antemortem	Not present	1
873	Yes - maxilla present only; all teeth lost antemortem	Not observable	0
874	Yes - mandible present only; right canine, m1, m2, m3 absent; left i1, m1, m2, m3 absent	Not present	1
875	Not observable	Not observable	0
876	Not observable	Not observable	0
877	Yes - right maxilla present; i1, i2, pm1, pm2, m1, m2, m3(?) missing antemortem	Not present	1
878	Yes - left maxilla and mandible present; left maxillary pm1, m3(?) lost antemortem; left mandibular pm2, m1, m3(?) missing; right mandibular m1, m2, m3(?) lost antemortem	Yes - LEH present on right mandibular c, pm2; left maxillary c, pm2;	3
879	No - mandible and right maxilla present	Not present	1
881	Yes - mandible and maxilla present; right mandibular i1, pm1, pm2, m1, m2, m3 lost antemortem; left mandibular i1, pm1, pm2, m1, m2, m3 lost antemortem; all maxillary teeth lost antemortem	Not present	1
882	Not observable	Not observable	0
884	Yes - mandible only	Not present	1

	present; left m2, m3 lost antemortem; right mandibular m1, m2, and m3 lost antemortem		
889	Not observable	Not observable	0
890	Yes - mandible and maxilla present; left maxillary i1, i2, pm1, pm2, m1, m2, m3 lost antemortem; right maxillary m1, m2, m3 lost antemortem; left mandibular m3 lost antemortem; right mandibular m1, m2, and m3 lost antemortem	Not present	1
891	Yes - maxilla and mandible present; right mandibular i1, c, pm2, m1, m2, m3 lost antemortem; left mandibular i1, i2, c, pm1, pm2, m1, m2, m3 lost antemortem; right maxillary i1, pm1, pm2, m1, m2, m3 lost antemortem; left i1, i2, c, pm1, pm2, m1, m2, m3 lost antemortem	Not present	1
892	Not observable	Not observable	0
894	Yes - maxilla and mandible complete; right maxillary i1, pm1, pm2, m3?; left maxillary i1, i2, pm1, pm2, m1, m3?; left mandibular m1, m2, m3; right mandibular m2, m3	Not present	1
897	Not observable	Not observable	0
898	Yes - left mandible and left maxilla present; all left maxillary teeth lost antemortem; all left mandibular teeth lost antemortem	Not observable	0
899	Not observable	Not observable	9
900	Yes - maxilla present only; left i1, i2, pm1, pm2, m1, m2, m3 lost antemortem; right i1, i2, m1, m2, m3 lost antemortem	Not present	1
902	Yes - maxilla present only; all teeth lost antemortem	Not observable	0
904	Yes - maxilla present only; left m3 lost antemortem	Yes - LEH - left i1, i2, right i1, i2, c	3

905	Yes - left maxilla present only; all teeth lost antemortem	Not observable	0
906	Yes - right maxilla present only; all teeth lost antemortem	Not observable	0
908	Not observable	Not observable	0
909	Yes - maxilla present only; all teeth lost antemortem	Not observable	0
910	Yes - maxilla present, mandible present; left maxillary m3 lost antemortem; right maxillary m1, m2, m3 lost antemortem; mandible teeth present except for right mandibular m3 because right mandibular ramus missing	Yes - LEH - left maxillary i2, c, pm1; right maxillary i2, c, pm1, pm2; right mandibular i1, i2, c, pm1; left mandibular i1, i2, c, pm1, pm2, m2	3
911	Yes - right maxilla present, all teeth lost antemortem; left mandible present, pm2, m1, m3 lost antemortem	Yes - LEH - left mandibular i1, i2, c	3
913	Not observable	Not observable	0
918	Not observable	Not observable	0
920	Yes - right mandible present only; right mandibular pm1, m1, m3 lost antemortem	Yes - LEH - right mandibular canine	2
923	Not observable	Not observable	0
925	Yes - distal right portion of mandible present only; m1?, m2, m3 not lost antemortem	Not present	1
928	Not observable	Not observable	0
929	Yes - left maxilla present only; all teeth lost antemortem	Not observable	0
930	Not observable	Not observable	0
931	Yes - right maxilla present only; all teeth lost antemortem	Not observable	0
933	Not observable	Not observable	0
936	Not observable	Not observable	0
937	Not observable	Not observable	0
942	Yes - right mandible present only; i1, i2, c, pm1, pm2, m1, m2, m3 lost antemortem	Not present	1
946	Not observable	Not observable	0
953	Yes - mandible present only, all teeth lost	Not observable	0

	antemortem		
955	Yes - right mandible present only; i1, i2, c, pm2, m1, m2, m3 lost antemortem	Not present	1
956	Yes - maxilla and mandible present; left maxillary i1,i2, pm1, pm2, m2; right maxillary i1, i2, pm2, m1; right mandibular pm1, m2, m3; left mandibular m1, m3	Yes - LEH present in right maxillary c	2
957	Yes - right maxilla and right mandible present only; right maxillary i1, i2, pm1, pm2, m1, m2, m3 lost antemortem; right mandibular - all teeth lost antemortem	Not present	1
958	Not observable	Not observable	0
959	Not observable	Not observable	0
961	Not observable	Not observable	0
964A	Yes - left maxilla present only; i1, i2, c, pm1, m3 lost antemortem	Not present	1
967	Yes - maxilla and right mandible present only; all maxillary teeth loss, right mandibular i1, pm1, pm2, m1, m2, m3 lost antemortem	Not present	1
971	Yes - left maxilla and left mandible present only; left maxillary m2, m3 lost antemortem; left mandibular m2, m3 lost antemortem	Yes - LEH - left maxillary i1, i2, pm1, pm2; left mandibular i1, i2, pm1;	3
975	Yes - maxilla and left mandible present; left maxillary pm1, pm2, m1 lost antemortem; left mandibular m1, m2 lost antemortem	Yes - LEH - left mandibular c, pm1; right mandibular c, pm1	3
977	Yes - maxilla and right mandible present; left maxillary i1, i2, pm1, pm2, m1, m2, m3 lost antemortem; right maxillary i1, i2, m1, m2, m3; right mandibular - all teeth lost antemortem	Not present	1
978	Yes - maxilla and mandible	Not present	1

	present; right mandibular i1, pm1, m2, m3?; left pm2, m1, m2, m3 lost antemortem; left maxillary i1, i2, c, pm1, pm2, m1, m2, m3; right maxillary i1, pm2 - this individual might not have had room in their mouth for m3s		
981	Not observable	Not observable	0
982	Yes - left maxilla and mandible present; left maxillary m1 lost antemortem; left mandibular pm2, m1, m3 lost antemortem; right mandibular pm1, pm2, m1 lost antemortem	Yes - LEH present right mandibular i2, c; left mandibular i2, pm1; left maxillary i1, i2,	3
985	Yes - left maxilla present only; left maxillary i1, i2, pm1, pm2, m1, m2, m3? Lost antemortem	Not present	1
986	Yes - right mandible present only; all teeth lost antemortem	Not observable	0
987	Yes - maxilla and right mandible present; right maxillary m2 lost antemortem	Yes - LEH - left maxillary i1, i2, pm1, pm2; left maxillary i1, i2, c, pm1, pm2, m1; right mandibular i2, c	3
988	Yes - maxilla and mandible present; right maxillary i1	Not present	1
1001	Yes - maxilla and mandible present; right maxillary pm1, pm2, m1, m2, m3; left maxillary pm1, pm2, m1, m2, m3; left mandibular m2, m3; right mandibular pm2, m1, m2, m3	Not present	1
1003	Not observable	Not observable	0
1007	Yes - maxilla present only; all teeth lost antemortem	Not observable	0
1009	Not observable	Not observable	0
1010	Yes - maxilla and right mandible present; right maxillary i1, pm1, pm2, m1, m3 lost antemortem; left maxillary i2, c, pm1, pm2, m1, m3 lost antemortem; right mandibular m1, m2, m3	Not present	1

	lost antemortem		
1026	Yes - maxilla and mandible present; left maxillary i1, m2; right maxillary i1, m1, m2, m3; left mandibular m1, m2, m3; right mandibular m1, m2	Not present	1
1030	Not observable	Not observable	0
1035	Not observable	Not observable	0
1037	Not observable	Not observable	0
1106	Not observable	Not observable	0
1108	Not observable	Not observable	0
1112	Not observable	Not observable	0
1115	Yes - mandible and maxilla present; left maxillary m3, right maxillary m3; right mandibular pm1	Yes - LEH - right maxillary i2, c; left maxillary i1, i2, c, pm1, pm2; right mandibular i2, c, pm2; left mandibular c;	3
1127	Yes - maxilla and mandible present - all teeth lost antemortem	Not observable	0
1154	Yes - maxilla and left mandible present; all teeth lost antemortem	Not observable	0
1244	Yes - right maxilla and mandible present; right maxillary m3 lost antemortem; right mandibular m1, m2, m3 lost antemortem; left mandibular m1, m2, m3 lost antemortem	Yes - LEH - right mandibular i1, i2; left mandibular i1, i2; right maxillary i1, i2, c, pm1; left maxillary i1	3
1262	Yes - maxilla and mandible present; right maxillary i1, i2, c, pm1, pm2, m1, m3; left maxillary i1, pm1, pm2, m1, m2, m3; left mandibular m1, m2, m3; right mandibular m3	Not present	1
1399	Not observable	Not observable	0
1403	Not observable	Not observable	0
1411	Yes - maxilla present only; all teeth lost antemortem	Not observable	0
1412	Not observable	Not observable	0
1427	Not observable	Not observable	0
1434	Not observable	Not observable	0
1439	Not observable	Not observable	0
1443	Not observable	Not observable	0
1145	Not observable	Not observable	0
1453	Yes - maxilla and mandible	Yes - LEH - left	3

	present; right maxillary pm1, pm2, m1, m2, m3 lost antemortem; left maxillary i2, pm1, m1, m2, m3; right mandibular pm2, m1, m2, m3; left mandibular m1, m2, m3 lost antemortem	mandibular i1, c; right mandibular c	
1454	Yes - maxilla and mandible present - all teeth lost antemortem	Not observable	0
1457	Not observable	Not observable	0
1458	Not observable	Not observable	0
1465	Not observable	Not observable	0
1470	Not observable	Not observable	0
1484	Yes - right maxilla and left mandible present only; all teeth lost antemortem	Not observable	0
1491	Yes - left maxilla and mandible present; left maxillary c, pm1, pm2, m1, m2, m3 lost antemortem; left mandibular pm2, m2, m3 lost antemortem	Not present	1
1494	Not observable	Not observable	0
1495	Not observable	Not observable	0
1533	Yes - maxilla and mandible present; left maxillary pm2, m1, m2, m3 lost antemortem; right maxillary m1, m3; left mandibular m1; right mandibular m1, m2, m3 lost antemortem	Yes - LEH - left mandibular i1, i2, c; right mandibular i1, i2, c, pm1; right maxillary i2; left maxillary i1;	3
1576	Not observable	Not observable	0
638A	Yes - left maxilla and mandible present; left maxillary i1, i2, pm1, pm2, m1, m2, m3 lost antemortem; all mandibular teeth lost antemortem	Not present	1
901A	Yes - mandible present only; left mandibular i1, i2, c, pm1, pm2, m1, m2, m3; right mandibular i1, i2, pm2, m1, m2, m3 lost antemortem	Yes - LEH - right mandibular pm1	2